DECEMBER 1970

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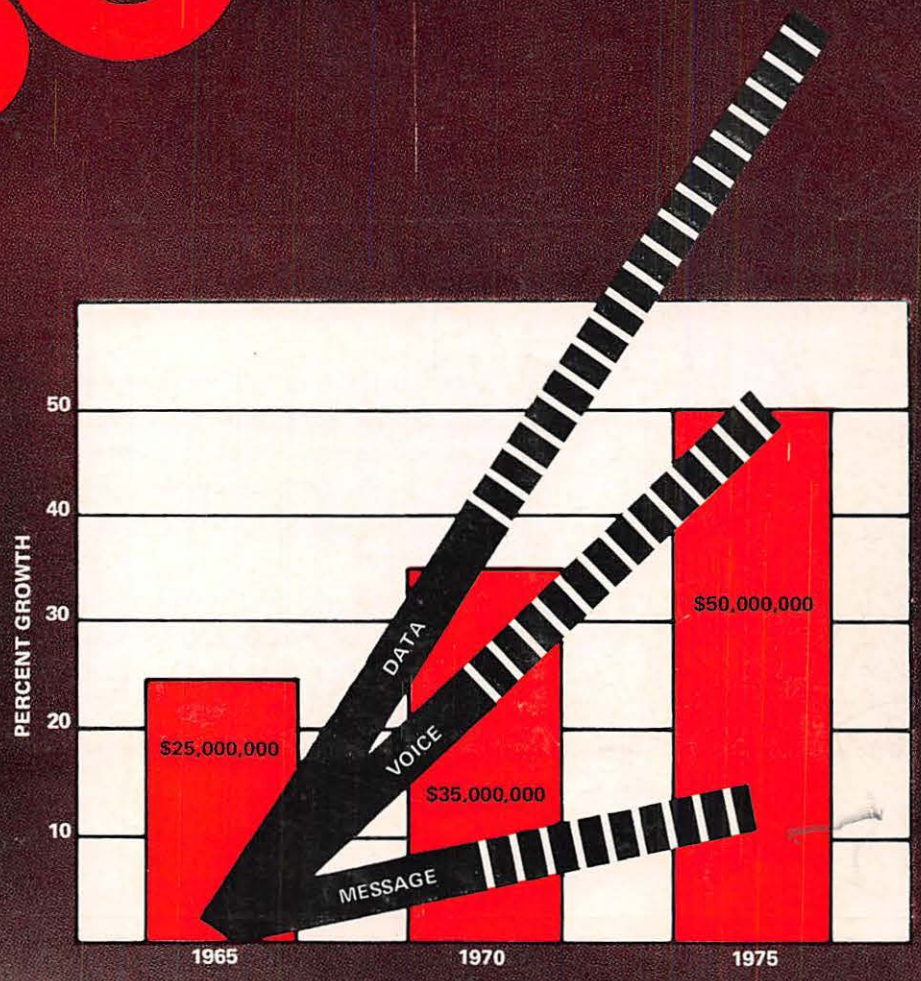

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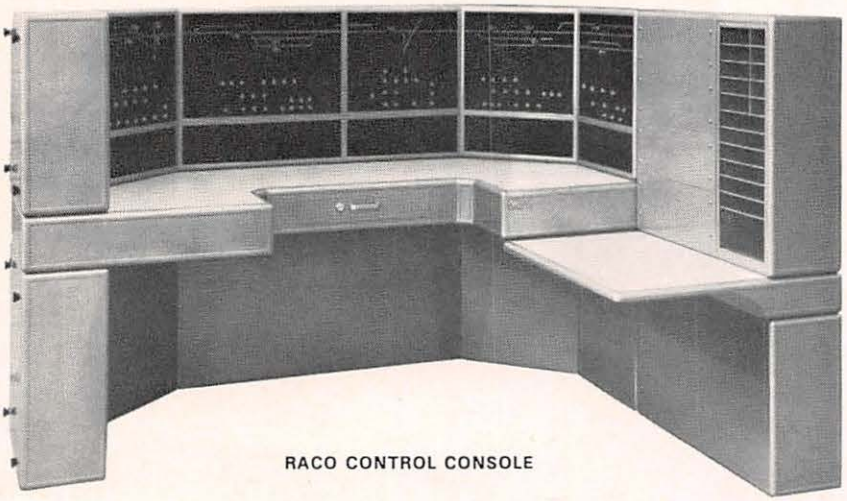

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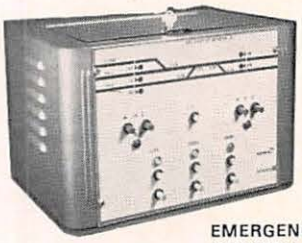

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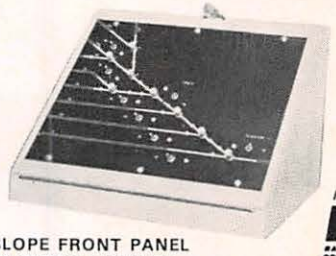

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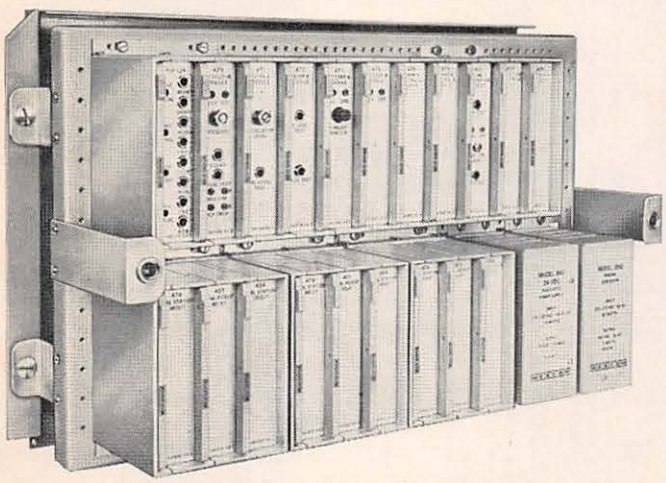

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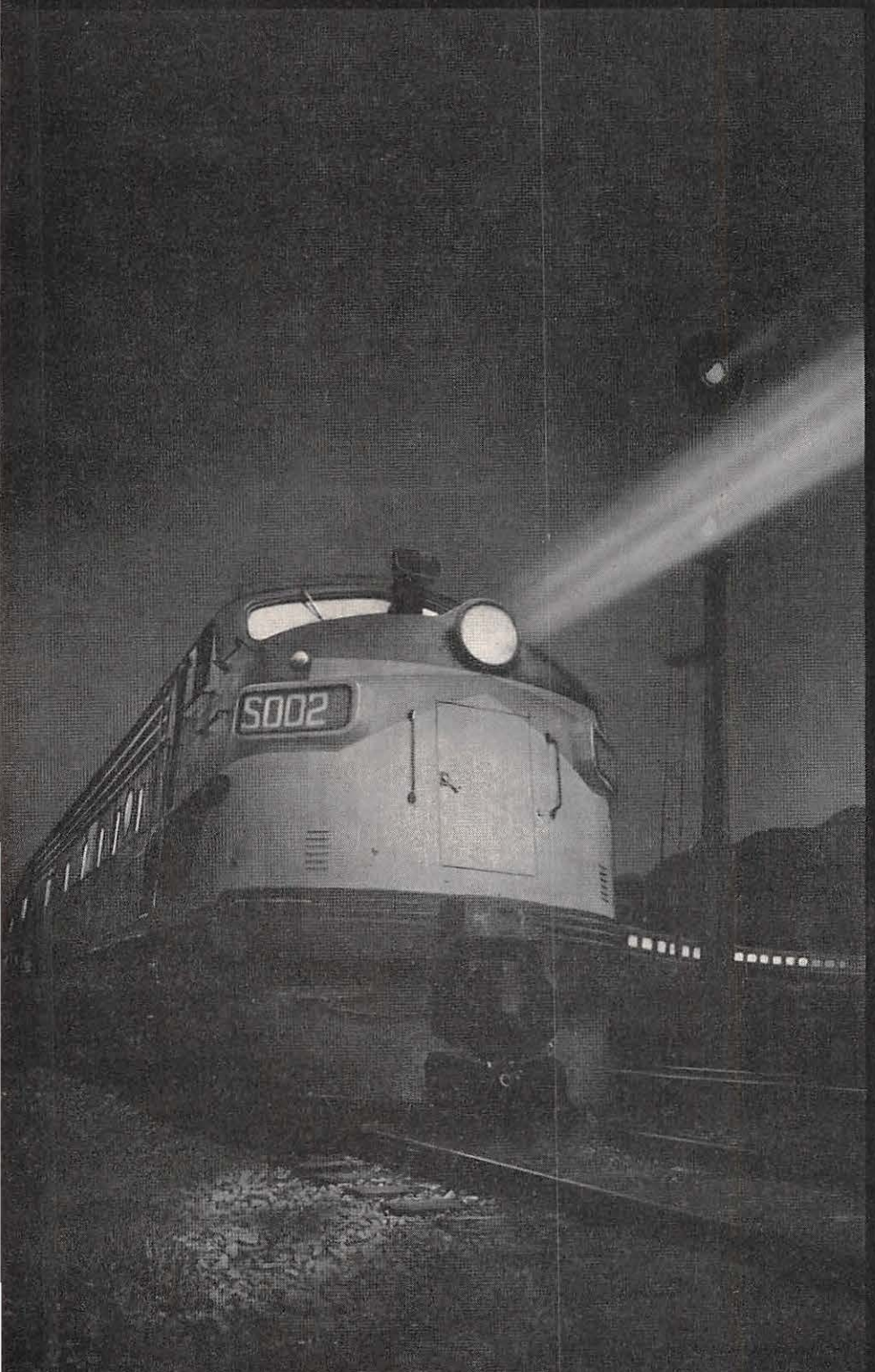

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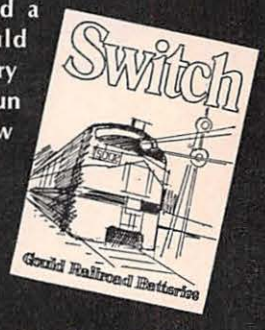

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DECEMBER 1970 VOL. 1 NO. 9

RSC RAILWAY SYSTEM CONTROLS

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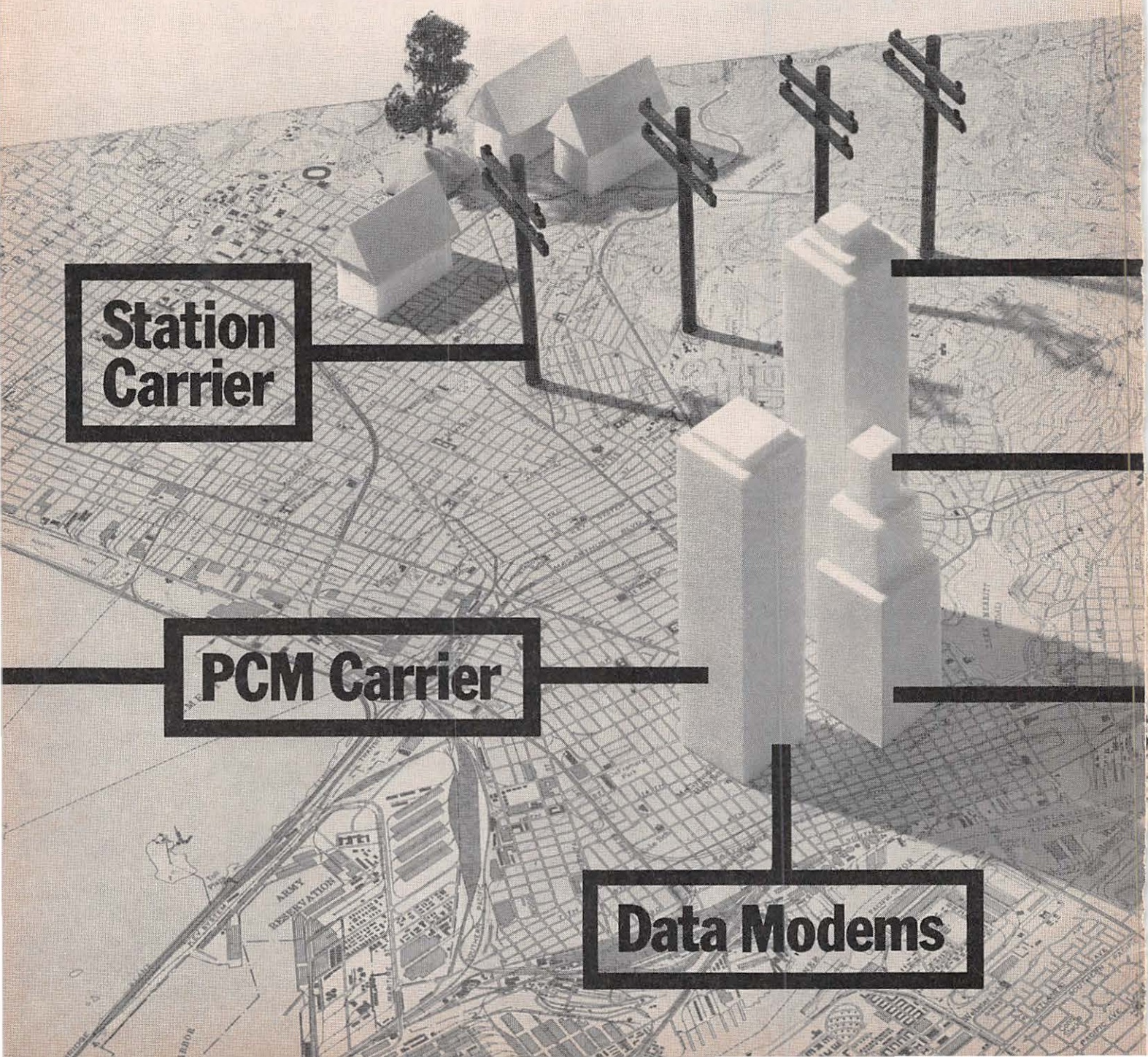

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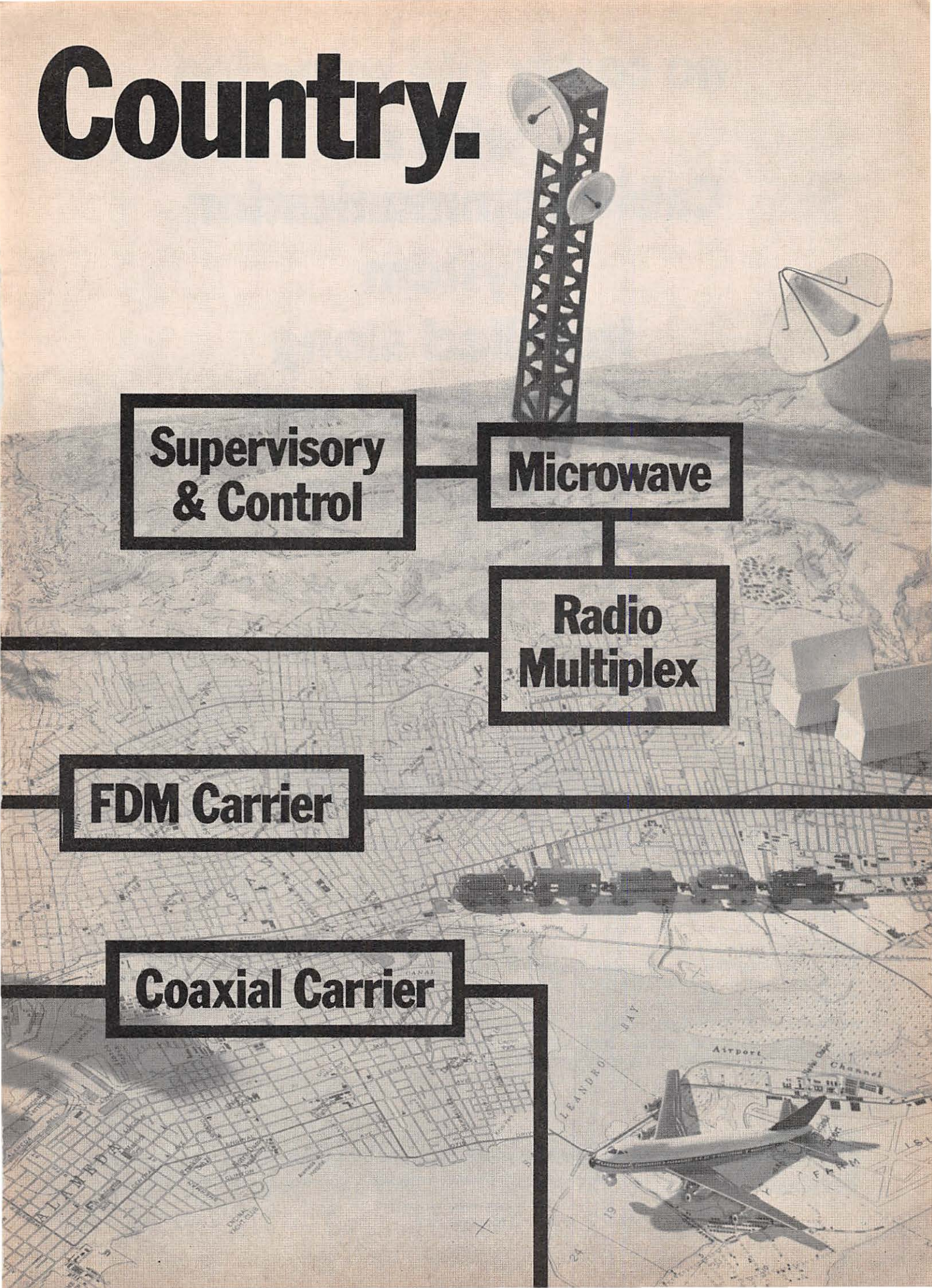
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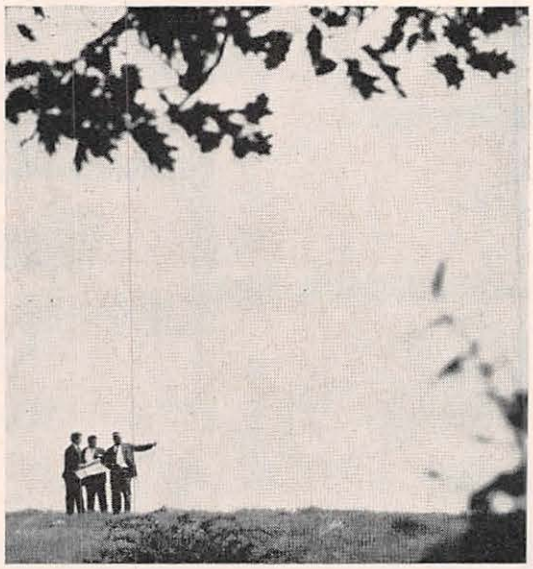

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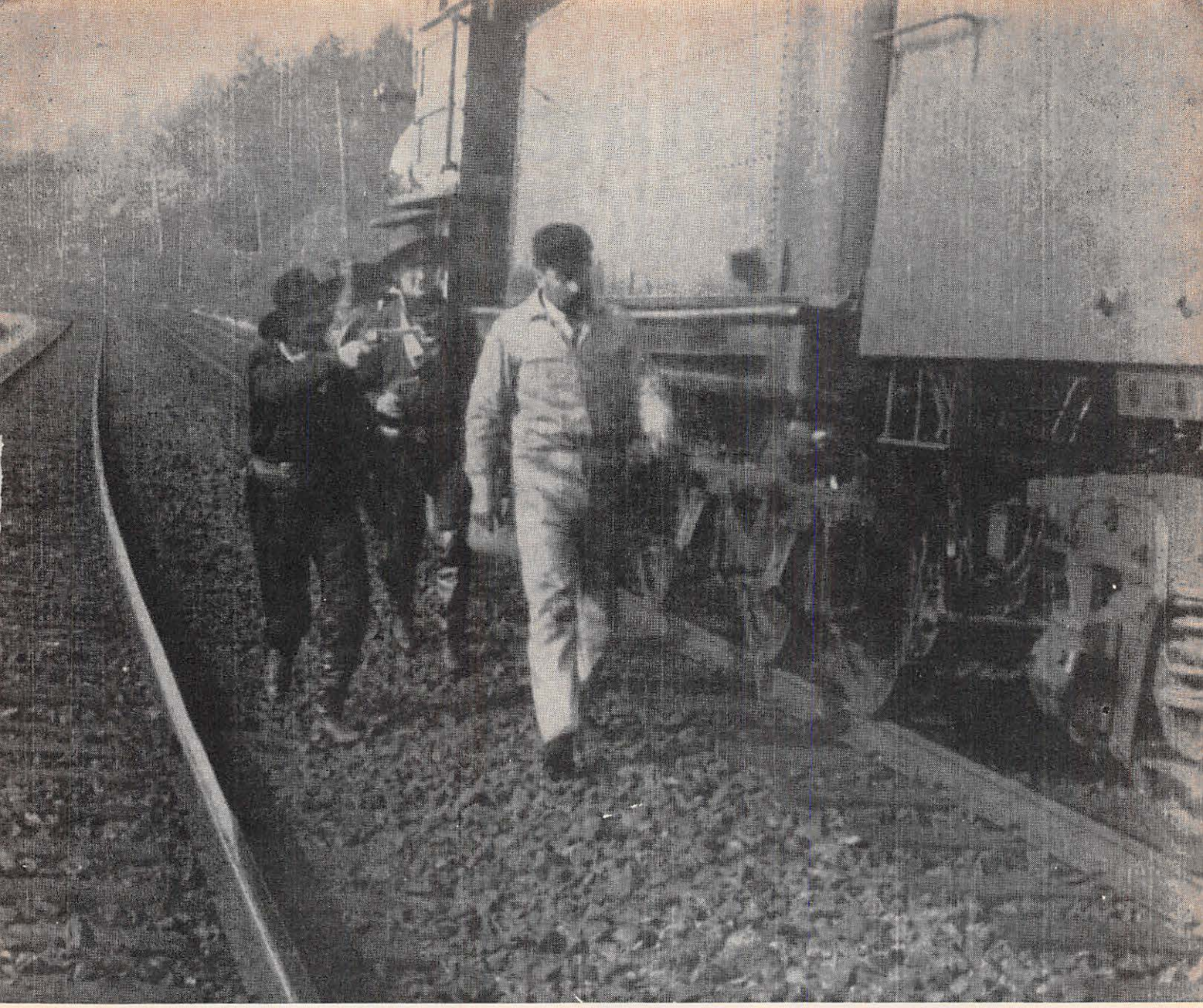


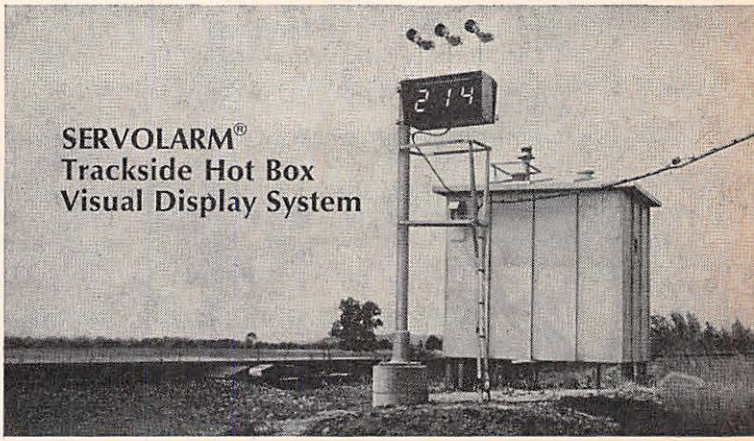
"Never you mind 'bout that new Servo display system you're gettin' next month—right now, start walkin' and don't stop till you find the hot box!"

EVEN without the guns pointed at him, our railroad friend's task of "walking the train" to find a hot journal box was not an enviable one. It certainly would have been simpler and quicker if he did have our new SERVOLARM® Trackside Hot Box Visual Display System.

Designed to operate with a standard SERVOSAFE® Hot Box Detector System, the SERVOLARM visually signals the presence of a hot journal box and also pinpoints its location by means of a digital readout axle count. SERVOLARM helps to eliminate train stops and crew delays. It simplifies and speeds up the entire hot box location procedure by directly notifying the crew via a trackside display board.

SERVOLARM can be quickly and easily installed with a minimum of construction equipment and labor, while eliminating long-distance wiring and extensive communication equipment costs. Compared to other, more complex methods of communication, SERVOLARM offers greater reliability and reduced maintenance.

Are you tired of looking for hot boxes the hard way? Take a look at SERVOLARM—just ask for Tech Data Publication 2013.



Bi-directional display board presents digital readout, showing axle count location of hot journal box. If no hot boxes are detected, display board reads "000". Flashing signal lamps on top indicate presence of hot box.

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- low standby drain
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Communications spending rises

Railroads will be spending more for communications equipment and services in the years ahead just to keep pace with usage. As the chart indicates, railroads in the U.S. and Canada will be spending about $50 million annually by 1975 just for additions and betterments to their communications plants. They will probably be spending a like amount for services, leased facilities and maintenance equipment and supplies.

Communications usage on the railroads has been growing at rates somewhat comparable with other communications users. Data transmission volumes are leaping at rates of 40-50% annually. Voice traffic is rising at 25-30% annually while message or administrative traffic is showing a growth rate of some 10% annually.

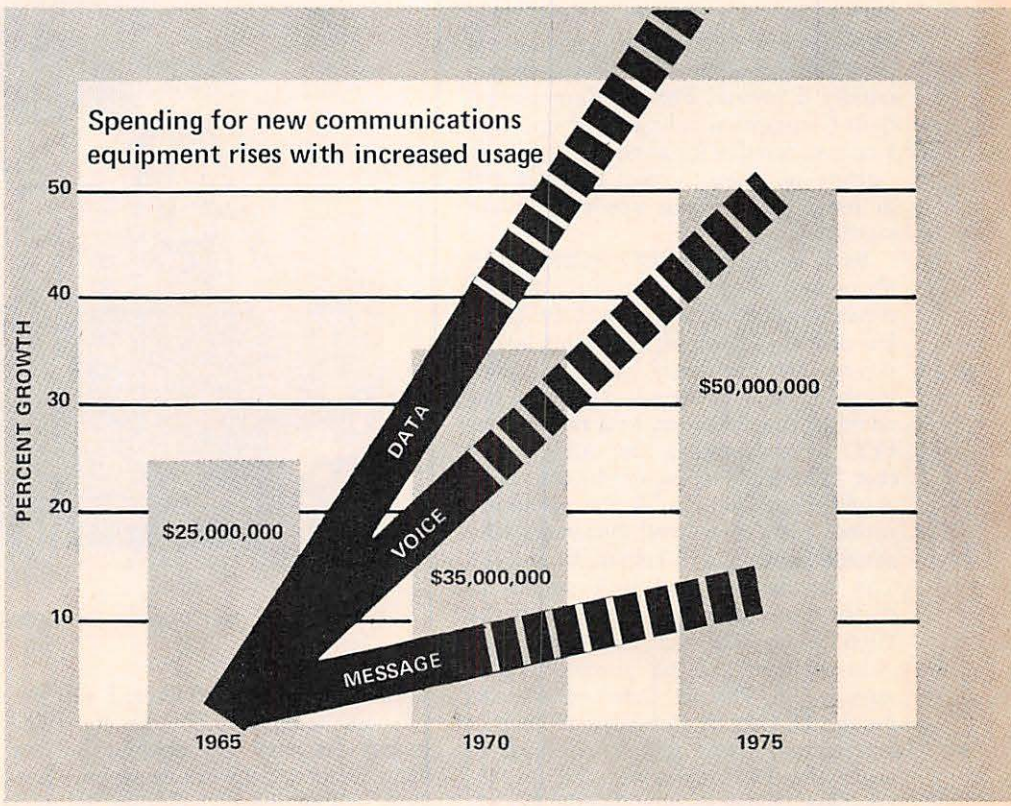
While experts are predicting that things will get worse before they get better on the common carrier—telephone and telegraph company facilities—side of the communications picture, railroads are fortunate in that most of them have their own facilities. Thus, they are able to plan and meet their communications requirements, not being dependent upon common carriers.

To meet the communications demands as indicated by type of traffic on the chart, railroad-owned microwave systems have been growing at the rate of some 2500 route-miles annually. By 1975, railroads in the U.S. and Canada are expected to have 50,000 route-miles of microwave systems in service.

In the area of two-way radio communications, mobile authorizations by the Federal Communications Commission now total about 100,000; and this should increase by 25,000 during the next five years.

In its annual surveys of communications equipment installations, *Railway System Controls* finds that railroads will continue to install about 25,000 units annually.

The impact upon communications by the computer has been tremendous. Computer requirements for communications links will continue to grow at a rapid pace. Looking into the 70's, Graham Claytor, Jr., president, Southern, had this to say at the 1970 annual meeting of the Data System Division, AAR:



"The Seventies will be the decade of terminal-oriented real-time systems. By terminal-oriented I mean that computer capability will be directly available to many people throughout the railway via communication networks and individual computer terminals."

After citing Southern, Seaboard Coast Line, Louisville & Nashville and Illinois Central computer direct inquiry systems for car tracing, Claytor said that "railroads should be able to work out an automatic computer-to-computer exchange of common data for their own benefit and that of customers."

Evidence of further communications requirements, especially for high-speed computer-to-computer links comes from Chesapeake & Ohio/Baltimore & Ohio. Dr. H. N. Laden, assistant vice-president research, C&O/B&O, told his Data Systems Division audience of his road's plans to implement an area control system/headquarters control system computer network. Six area control systems each built around a computer for handling data processing on a regional basis will be located at Baltimore, Md., Richmond, Va., Huntington, W.Va., Cincinnati, Ohio, Pittsburgh, Pa., and Detroit, Mich. Each regional computer will be linked to the headquarters computer at Baltimore.

From an operational standpoint, Illinois Central has a combined communications and computer services department. "Merging of communications and data processing is a gain for both," says George Pipas, vice-president communications and computer services. "The systems knowledge of data processing is available to communications experts, and the expertise and technical ability of the communications engineer is available to the systems analyst and data processing manager."

Communications: Where will the

money be spent? Obviously, money will be spent in two major areas: for equipment and facilities to expand railroads' privately owned communications plant; and to lease services and facilities from communications common carriers or equipment manufacturers. Also obviously, many roads will spend money in both areas. But a shift toward more expenditures for private communications is discernible, and may pick up rapidly if present Federal Communications Commission rulings hold up. Rate increases are due for almost all common carriers' offerings to meet inflation and to meet the growing needs for plant expansion.

Back in August, FCC ordered telephone and telegraph companies to "file revised tariffs that will extend the benefits of the Telpak shared rates to all private line customers, without regard to their lines of business." FCC has voted to stay its order. In a petition for FCC reconsideration, the AAR stated that "The elimination of sharing alone would more than double the communications costs of railroad customers who actually now share Telpak C and D. The elimination of Telpak would increase the communications costs of the Penn Central Co. by at least five times."

In another look at present Telpak rates a U.S. District Court of Appeals for the District of Columbia is hearing arguments for and against a request to order the FCC to reject the present rates for Telpak service. While there is much legal maneuvering concerning the Telpak bulk communications tariff, one conclusion appears to be that whatever happens, rates will rise.

The thinking of some communications experts is to make the best of both worlds—lease and buy. For railroads, they have to use leased communications circuits to reach off-line traffic offices. Having rights-of-way, they can provide their own communications plant for on-line offices. Some railroads use a combination of their own equipment and those of the communications common carriers. C&O/B&O, for example, will install a new electronic telephone exchange at Cumberland, Md. The switchboard will be leased from Stromberg-Carlson Corp. for interconnection with the Chesapeake & Potomac Telephone Co. The new system will provide Tone-Dial telephone service for division headquarters personnel over the railroad's private communication system and message circuit lines and access to the nationwide telephone net.

MICROWAVE can provide the bulk communications so essential for railroad's

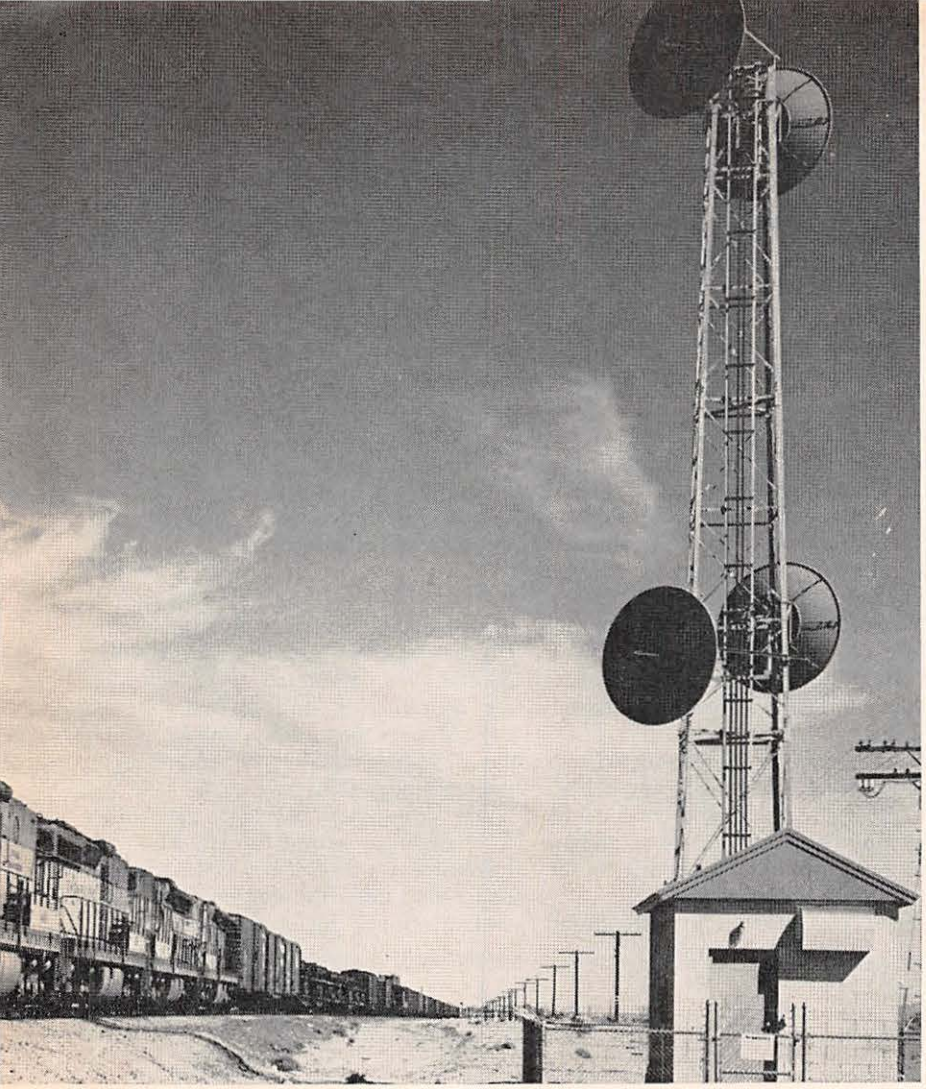
The Crossreed switchboard will provide 300 telephone lines for the B&O. It will also have the capability of handling future data transmission. Also, users will be able to call a special number for a large telephone conference, or on equipped phones, add a distant party to an existing call by dialing that party. Paging throughout the headquarters building will be possible from any telephone on the new system.

The Crossreed switchboard is self-testing. However, B&O will provide its own service and maintenance.

The C&O/B&O example cited above is typical of the manner in which many railroads will expand their communications plant and interconnect with the public telephone network. Interconnection of customer-owned facilities with the public telephone network is now permitted. There is the question of providing protection for the public system from electrical interference or disturbances from customer-owned equipment. A National Academy of Sciences study commissioned by the FCC called for protective arrangements required by the tariffs and a properly authorized and enforced certification program to provide the necessary protection to the telephone network.

In commenting on the NAS report, Southern Pacific Communications Co. agreed generally and backed a certification and standards program. This, it said, "would allow certification of the fact that a device proposed to be connected to the telephone network did in fact contain . . . an isolating device which would insure that the telephone network would not be exposed to harmfull voltages, wave forms, or frequencies. If the device did not contain such an isolation device, it could still be certified for connection, provided it were isolated from the network by an appropriate connecting arrangement, whether provided by the carrier or the customer."

The AAR noted that the panel report apparently suggests that "all right-of-way companies such as the railroads would require certification of all equipment now interconnected." Instead, AAR declared, those which have been interconnected for years should have "grandfather" rights. It also backed certification by manufacturers, declaring that "too little weight has been given to the historic relationship between the common carriers, the right-



operational requirements.

of-way users, and the supply industry."

For railroads, as well as others, the relaxed interconnection regulations means that they would not be required to lease the connecting or interface equipment from the telephone or telegraph companies. Some experts forecast that this will be an incentive for many roads to purchase their own dial exchange equipment which will be interconnected to the public telephone system.

In one area, U.S. railroads with private microwave systems may be in a position to make money from their communications facilities. FCC has taken the position that there may be specialized common carrier services in the domestic public point-to-point microwave radio service in competition with the telephone and telegraph companies. So far only one railroad has seized the opportunity, that being Southern Pacific, which has formed a subsidiary company (SP Communications Co.) which has applied to the FCC to provide specialized services via its microwave system extending from Seattle, Wash. to San Diego, Cal., and from Los Angeles, Cal. to St. Louis, Mo.

The real opportunity, notes one communications engineer, is that at a minimum cost a railroad with a private microwave system could probably provide additional communications services. For example, it might only require the installation of microwave equipment at existing repeater stations including RF units, multiplex and antennas. It may be possible to mount antennas on existing towers. Much of the initial costs in surveying for paths, locating station sites, constructing buildings, providing power sources, access roads, etc. are already paid for. Also, railroads with their own microwave systems have skilled maintenance personnel available. Another communications engineer states: "The additional microwave equipment for these specialized services would not be an undue burden on our maintenance forces."

It certainly appears that with the tremendous growth in communications requirements of industry and the general public that tremendous pressure is mounting on the communications common carriers. Not so much as to relieve the pressure, but to satisfy the public needs, the FCC is moving toward the direction of more competition. According to *Telecommunications Reports*, the Commission has a "long-standing precedent" in which the U.S. Supreme Court said that the FCC should not grant applications merely for the sake of competition, but should do so if "reasonably feasible" competition will permit it to "at least warrant" that there will be some affirmative public benefit. Railroads which have their own private microwave systems would appear to have the edge in competing for business as specialized common carrier services in the point-to-point microwave service.

Communications: where will the money be spent? Railroads will continue to spend increasing amounts to satisfy their communications requirements that are rising each year. There may be a leveling off or even a slight decline in the percentage spent for leased facilities because of the generally upward trending of rates and of the present unsettled tariff situations with regard to matters pending with the FCC. Many railroads have and some are for the first time seriously considering the purchase of communications equipment to make themselves as independent as possible as regards communications facilities. There will still be considerable leased communications services, but some watchers of the railroad scene see an upturn in the purchasing of communications equipment due mainly to the uncertainty of the pricing and service performance of the common carriers.

To meet its growing communications needs, Burlington Northern, for example, has awarded a $1.2 million contract to Stromberg-Carlson Corp. to merge and enlarge its telephone systems into an integrated network. S-C will supply three new tandem switching centers and enlarge five existing S-C equipped centers. The resulting network will link 46 private automatic branch telephone exchange (PABX) systems along the railroad.

Railroad communications spending in the Seventies will be concentrated on data transmission facilites, input/output devices for computers, tone dialing phones and switchboards, microwave and two-way radio equipment.

In addition, the requirement for communications links to ACI scanners should boost the railroads' overall communications needs.

By all indicators, railroad communications facilities and money spent for communications services will be increasing during the Seventies.

Canadian National connects ACI

A description of Canadian National's pilot project to determine the feasibility of linking automatic car identification systems to real-time computing was described at the Data Systems Division, AAR, annual meeting in Atlanta, Ga., Sept. 28-30, 1970. An abstract of a paper presented by R. Cass, senior research engineer, CN, follows:

In 1969 the CN transportation and research departments decided to attempt a pilot project to show the feasibility of a real time link between an ACI scanner and a mini-computer. The experimental area is (Figure 1) Parsley, a small interchange yard near our main yard at Montreal. Cars are interchanged with Canadian Pacific at the rate of about 120 to 150 per day. Scanners were placed at each end of the yard and connected to a mini-computer using a CN designed interface and frequency modulated carrier. At the computer end the serial transmission is reassembled, multiplexed and fed on parallel lines to the computer. The reassembler multiplexer is also CN design. The computer prints on its standard ASC II Teletype machine and also

MANAGEMENT INFORMATION

Canadian National has installed automatic car identification scanners at entrances to a small interchange yard near its large Montreal classification yard. At Parsley yard, CN interchanges approximately 120-150 cars daily with the Canadian Pacific. As part of the joint agreement with CP, the ACI scanners were also to be part of a stand-alone installation supplying standard Baudot Teletype listing to the CP yard office.

The ACI scanners are connected to a minicomputer in real time using a high speed frequency modulated carrier link. The computer prints out on standard ASCII Teletype and also sends to the CP yard office teletypewriter.

From a cost standpoint, CN found that the economic advantage of using the minicomputer comes about from not ordering existing options. It is assumed that the computer will do nothing more than produce the same output data as a standard scanner. Options not required at each installation include a calendar clock, message generator, core storage and carrier index, totaling $9,460. Not estimated were costs for air conditioning and a 220-volt AC line. Typical costs for a minicomputer are $7,900 or $12,800 depending upon main memory size.

The computer provides the ability to change the output format. Also, one computer could service 6 to 12 scanners depending upon the degree of sophistication required for operations.

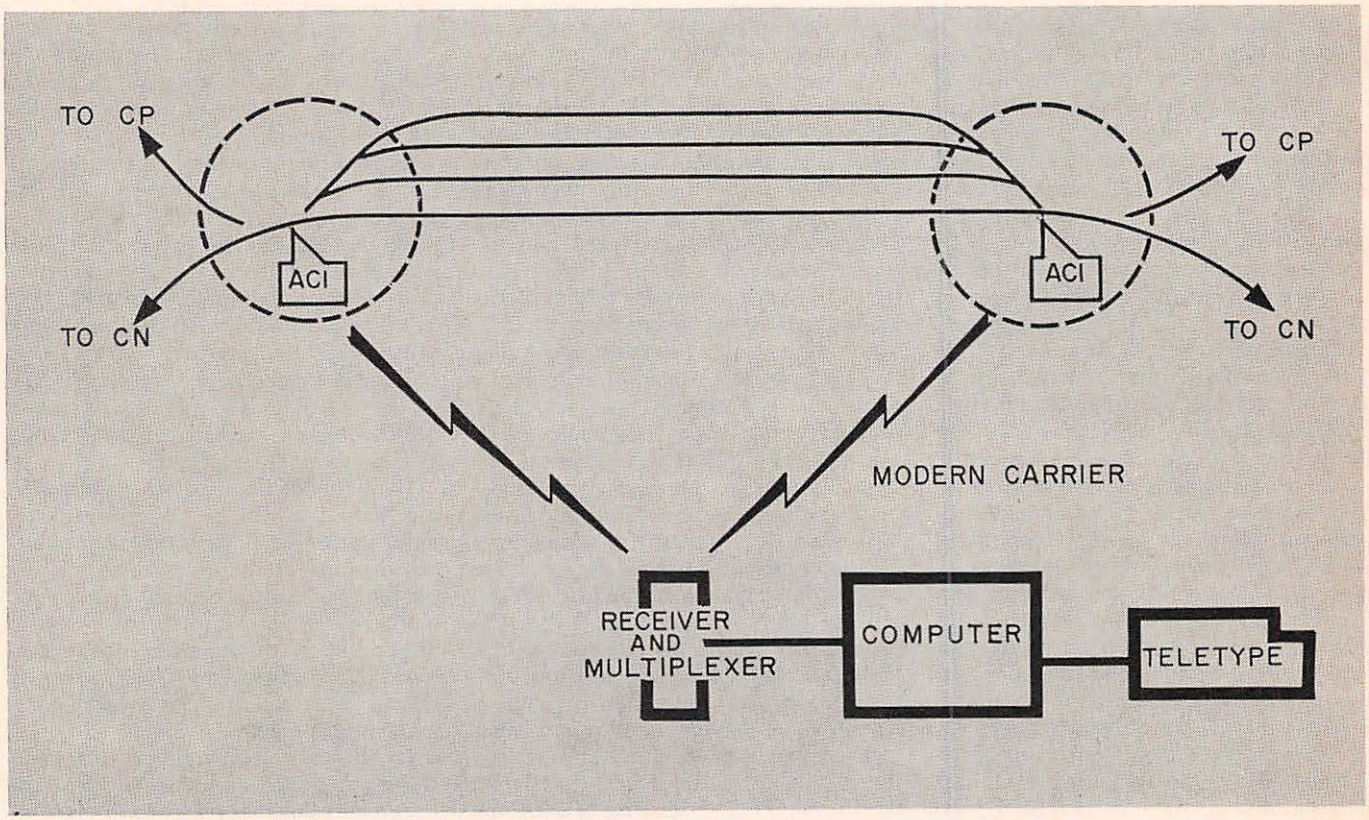


FIGURE 1—CN's Parsley interchange yard, Montreal, handles 120-150 cars daily with Canadian Pacific.

to minicomputer in real-time

operates a five-level machine via a CN translator.

Cars can enter or leave Parsley at either end in a perfectly general way. Normal operation includes shunting past the scanners in both directions as cars are placed on the various tracks. The aim of the investigation was to deduce exactly what the net transfer into or out of the yard was on any given movement and to update the yard inventory.

As part of a joint agreement with Canadian Pacific, the ACI scanners were also to be part of a stand-alone installation supplying standard Baudot Teletype listing to the CP yard office; for this reason the scanners were "full-kit" including storage, message generator, etc. Thus, for our application we had to build an interface with a storage register to receive the data at high speed as the non-parity detector register was writing into core storage.

Figure 2 shows a simplified diagram of the CN interface. An essential element of this system is the necessity of tagging the car label information with the field conditions existing at the instant the car was read. Read-in requires about 700 micro-seconds and is under control of the ACI clock. Read-out then commences at the required read-out clock rate. Presently, we are using 200 bits per second but there is no limit on this rate imposed by the interface, only by the modem set. The output format consists of four 16 bit words. The whole information package is sent twice.

Figure 3 is a simplified diagram of the logical operations that must be carried out. The neighbourhood of each scanner is track circuited, both to turn the scanners on and to inform us that a movement is starting. A movement is declared "on" if: (1) A track circuit is occupied, or (2) an engine is "in" the pool. This last fact is determined by checking the direction of an engine or noting the direction of the last car at the time occupancy was lost. Movements starting from CN must finish to CN; CP moves are treated similarly.

The computer stores every reading, noting direction (in or out) and when the movement is declared finished, summarizes by cancelling "ins and outs" for the same car number. This produces the movement summary report. The net movement is next added to, or extracted from, the inventory log. Manual entries into or out of the inventory are made via the keyboard for corrections.

Figure 4 depicts the major components in the data transmission link. The received bits are integrated for almost a whole bit time to reduce noise sensitivity.

Sixteen-bit words carry the information read-out of the interface. The following data is contained within the four 16 bit words which make up one transmission: (1) Four "field conditions" bits and their complements; namely: (a) occupancy, (b) scanner parity, (c) CN or CP lead and (d) direction (in or out). (2) A parity code of 2 bits which checks even/odd parity on each of the two pairs of bits in (1) above. (3) Ten binary coded decimal, car numbers. (4) One binary coded decimal, parity digit. (5) A block of eight "1's" in the last word.

Upon receipt of this information the computer assembles this data and pro-

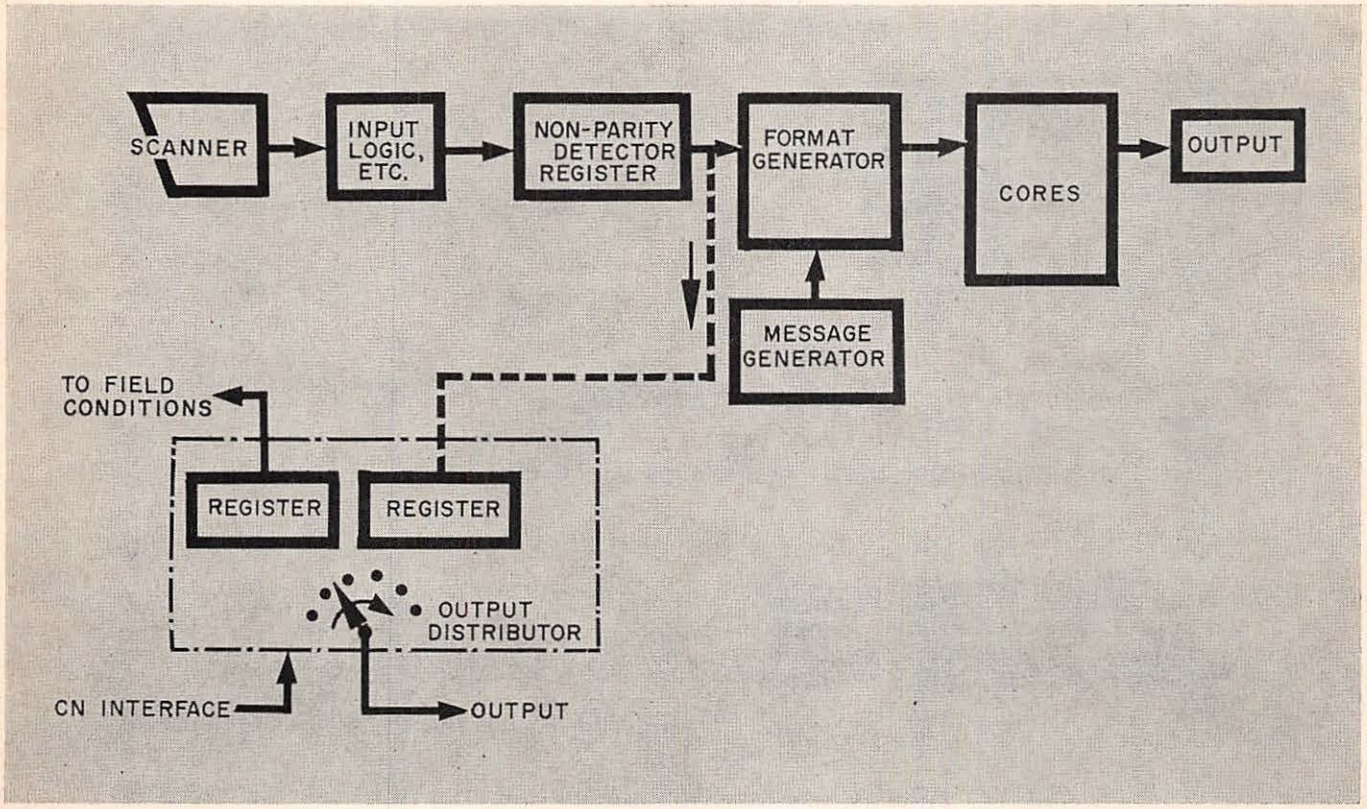


FIGURE 2—CN interface has key element of tagging car label data with instantaneous field conditions.

DATA SHEET

```
#1  FROM  CN  0- CN -485117
#1  FROM  CN  0- CN -476141
#1  FROM  CN  0- CN -481716
#1  FROM  CN  0- CN -481416
#1  FROM  CN  0- CN -537284
#1  FROM  CN  0- CN -486683
#1  FROM  CN  0- CN -798204
#1  TO    CN    NO  LABEL
#1  TO    CN  0- CN -798204
#1  TO    CN  0- CN -486683
#1  FROM  CN  0- CN -486683
#1  FROM  CN  0- CN -798204
#1  FROM  CN  0- CN -566187
#1  FROM  CN  0- CN -476552
#1  TO    CN  0- CN -123148-?
#1  TO    CN  0- CN -476552
#1  TO    CN  0- CN -566187
#1  FROM  CN  0- CN -798204
#1  FROM  CN  0- CN -566187
#1  FROM  CN  0- CN -476552
#1  FROM  CN  0- CN -123148-?
#1  FROM  CN  9- CN -108056
#1  TO    CN  9- CN -108056
#1  TO    CN  0- CN -123148-?
#1  TO    CN  0- CN -476552
#1  TO    CN  0- CN -566187
#1  TO    CN  0- CN -798204
#1  TO    CN  0- CN -486683
#1  TO    CN  0- CN -537284
#1  FROM  CN  0- CN -481416
#1  FROM  CN  0- CN -537284
#1  FROM  CN  0- CN -486683
#1  FROM  CN  0- CN -798204
#1  FROM  CN  0- CN -566187
#1  FROM  CN  0- CN -476552
#1  FROM  CN  0- CN -123148-?
#1  FROM  CN  9- CN -108056
#1  FROM  CN  9- CN -108056  OCC.
#1   TO   CN  9- CN -108056
#1   TO   CN  9- CN -108056  OCC.
```

PARSLEY INTERCHANGE REPORT

```
FROM  CN  0- CN -485117
FROM  CN  0- CN -476141
FROM  CN  0- CN -481716
FROM  CN  0- CN -481416
FROM  CN  0- CN -537284
FROM  CN  0- CN -486683
FROM  CN  0- CN -798204
FROM  CN  0- CN -566187
FROM  CN  0- CN -476552
FROM  CN  0- CN -123148-?

XMISSIONS TOTAL          :0080
BAD XMISSIONS TOTAL      :0000
DOUBLE BAD XMISSIONS     :0000
LOSS OF SYNCHRONISATION  :0000
UNLABELED CAR TOTAL      :0002
```

END

PARSLEY INVENTORY

```
FROM  CN  0- CN -485117
FROM  CN  0- CN -476141
FROM  CN  0- CN -481716
FROM  CN  0- CN -481416
FROM  CN  0- CN -537284
FROM  CN  0- CN -486683
FROM  CN  0- CN -798204
FROM  CN  0- CN -566187
FROM  CN  0- CN -476552
FROM  CN  0- CN -123148-?
```

END

PARSLEY INTERCHANGE REPORT

```
TO  CN  0-104 -124148-?
TO  CN  0- CN -476552
TO  CN  0- CN -566187
TO  CN  0- CN -798204
TO  CN  0- CN -486683
TO  CN  0- CN -537284
TO  CN  0- CN -481416
TO  CN  0- CN -481716
TO  CN  0- CN -476141
TO  CN  0- CN -485117
```

UNRECOGNIZED CAR(S)

INTERCHANGE REPORT — INVENTORY

```
TO  CN  0-104 -124148-?  ASSUMED TO BE  FROM  CN  0- CN -123148-?
```

```
XMISSIONS TOTAL          :0028
BAD XMISSIONS TOTAL      :0000
DOUBLE BAD XMISSIONS     :0000
LOSS OF SYNCHRONISATION  :0000
UNLABELED CAR TOTAL      :0000
```

END

FIGURE 5—Computer print out with data sheet (top left) shows listing exactly as moves took place.

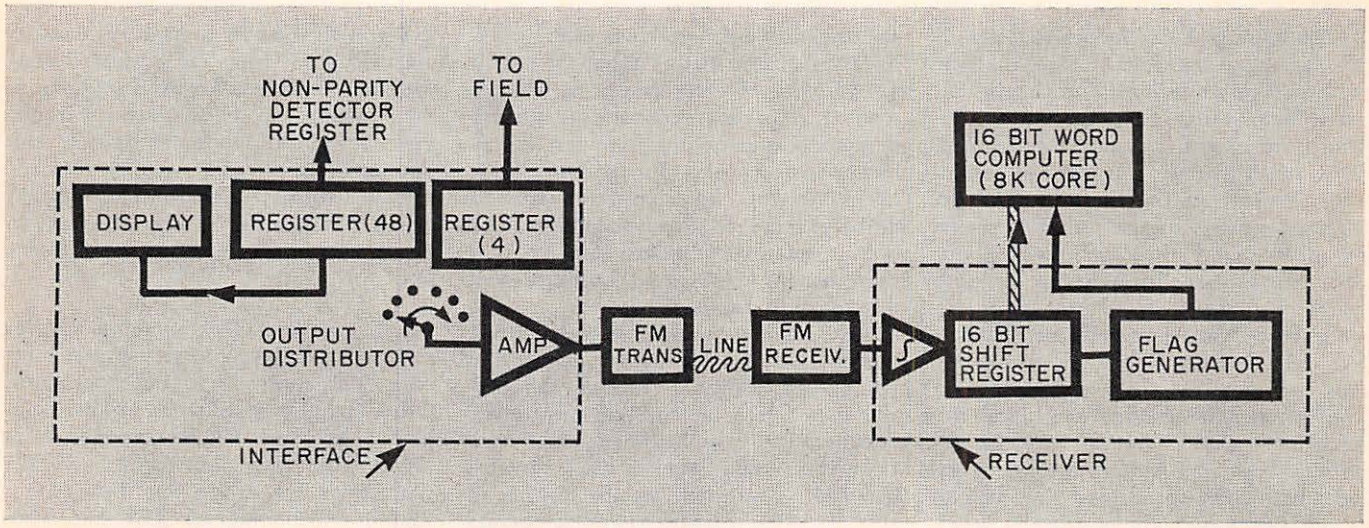


FIGURE 4—Major components of data transmission. Received bits are integrated for almost a whole bit time.

ceeds to check as follows: (1) All field bits have their complements. (2) No digit position except the parity digit can be greater than "nine". (3) The field bits parity code checks. (4) Label parity is re-calculated and compared to the parity digit. (5) The block of "1's" is in the correct location. (6) The next group of four words satisfies these conditions and is identical to the first transmission.

If the computer cannot make sense out of the first transmission group it successively drops words from the first transmission and includes words from the second transmission in an attempt to find at least one set of four words that checks properly. If it succeeds, the assumption is that the message has been received at least once out of two tries. If the computer cannot assemble a valid group it denotes a double bad transmission and prints its last attempt followed by an "X".

Figure 5 shows some results taken off the printout. The first of the figures lists exactly the move as it took place in order to see more clearly some of the ambiguities that can arise during shunting operations. In particular, a "ghost" car can appear if the wheel counter goes to 7 before a label is read during a direction change. This can easily come about if the labels are near the center line of cars.

In another case, the label was dirty and did not read the same on several successive passes (a 3 changed to a 4). The computer is programmed to suspect this car may be the same as the first reading; it prints out the proper statement on the inventory report.

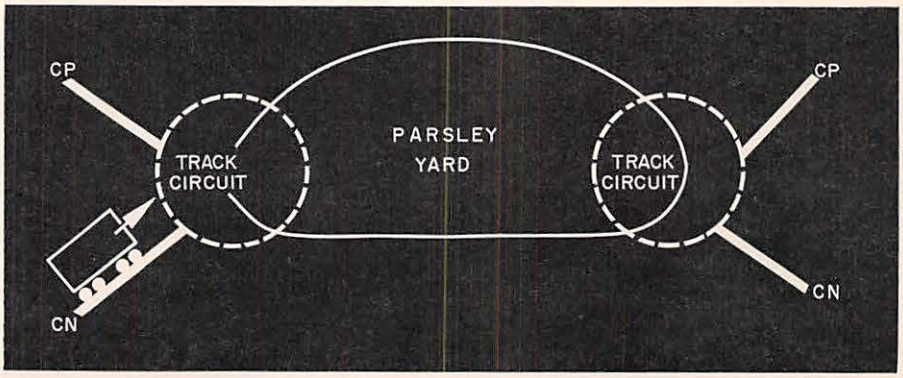


FIGURE 3—Simplified diagram shows logic operations. Track circuits near scanners indicate when moves made.

Options not required at each installation.

Clock	$ 960
Message Generator	700
Core Stores	4,700
Carrier Index	3,100
	$9,460

Output System approximately same as Interface

Air Conditioning, 220 volt line — not estimated

Typical Computer Costs:

Hewlett-Packard	2114	4k	$7,900
Hewlett-Packard	2114	8k	$12,800

FIGURE 6—Comparative costs for options not required when using minicomputer.

ACI installations will be grouped near main yards

The work that CN has carried out so far has suggested that ACI installations will tend to naturally group themselves near main yards. Since this is where trains are broken up and re-assembled, it is not therefore a surprising assertion. Preliminary surveys of our own railway system suggests that between two-thirds and three-quarters of our total installations will be in or near yards. For want of a better term, we call these "yard-centered" or "clustered" installations. Our work at Parsley has convinced us that local storage in the scanner is decidedly a disadvantage for logical operations and this reinforces further a system of basic scanners with high speed, real time link to a minicomputer. The storage is in effect simply removed from the field location and placed in a habitable area (main yard office).

Figure 6 shows a very simple comparative cost exhibit. Note that no assumptions are made about reducing the number of components in a basic scanner. The only economic advantage depicted comes about from not ordering existing options. Furthermore, it is assumed that the computer will do nothing more than produce the same output data as a standard scanner. It is seen that there is a cost advantage even at one computer to one scanner.

An enormous advantage is realized, however, if we take advantage of the computer's ability to change the output data format as outlined previously. Furthermore, we estimate that one computer could service six to twelve scanners, depending on the degree of sophistication it was required to operate at. Simplified maintenance and reduced installation costs as well as battery operation (without air conditioning) are obvious secondary advantages.

Figure 7 shows a routine for producing yard cards from the advanced consist deck and clean-list ACI logic from the scanners. The clean-list train would use about 400 computer words; the program, about 1500 words; the advanced consist deck, about 3,000 words. This routine is also observed to be an editing operation on the ACI data.

Editor's Note: This is one of a series of articles designed to acquaint readers with ACI applications and operations. Other articles published in 1970 include: Missouri Pacific experience at Dupo, Ill. (**rsc** Jan. pages 32-37); Guidelines for usage (**rsc** Feb. pages 22-23); Economics of ACI (**rsc** Mar. pages 22-23); Chicago terminal ACI study (**rsc** Aug. pages 26-31); AAR sets interface standard (**rsc** Nov. pages 14-19).

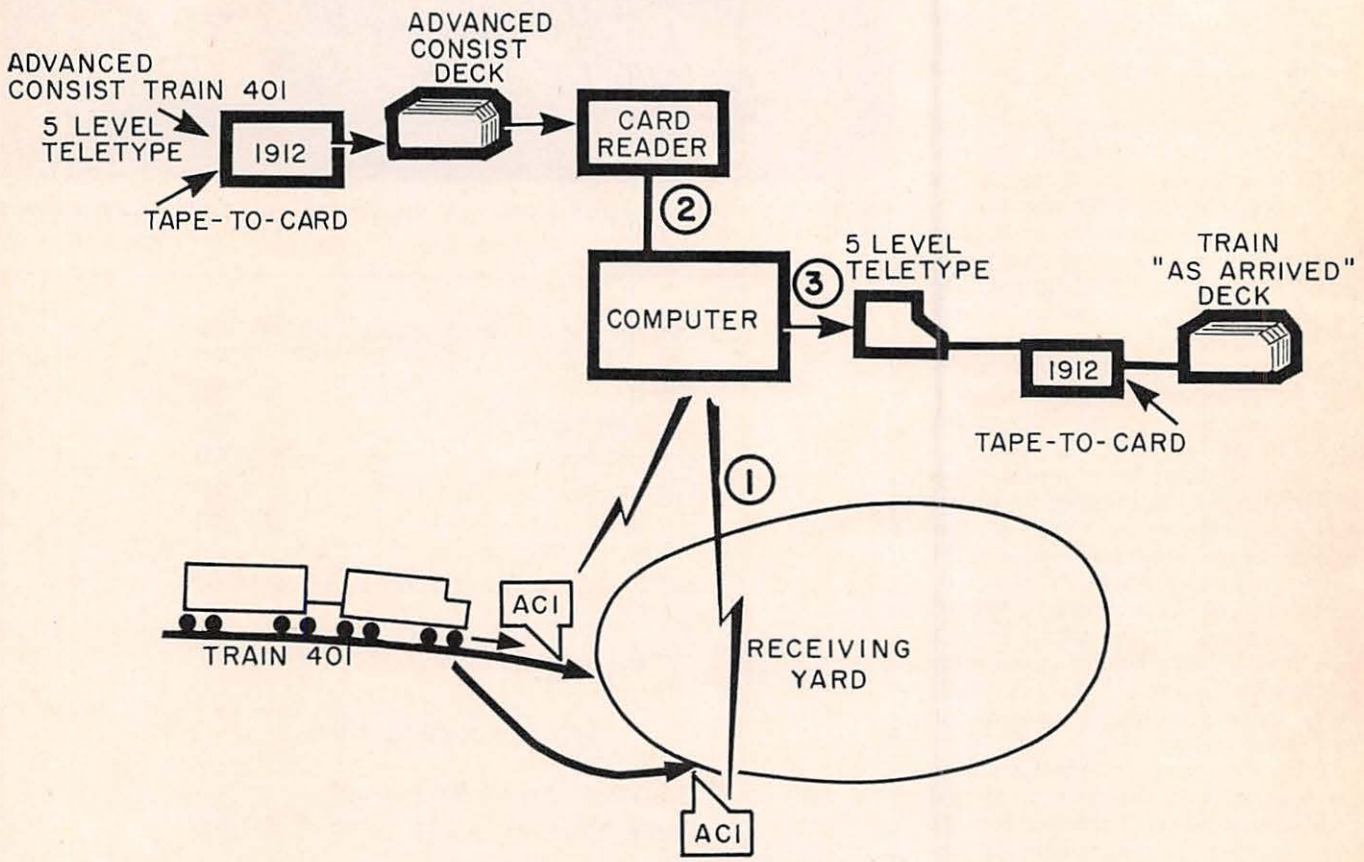


FIGURE 7—How to produce yard cards from advanced consist deck and clean-list ACI logic from scanners.

OPERATOR CONTROLS LOCOMOTIVE by radio. Lights on cab tell status.

Radio controlled units help steel company

Bethlehem Steel uses remotely-controlled locomotives and self-propelled scrap vehicles at its Burns Harbor plant.

Locomotives and self-propelled scrap vehicles are remotely controlled via radio at the Burns Harbor plant of Bethlehem Steel Corp. in northern Indiana on the shores of Lake Michigan. Locomotives maneuver trainloads of coal and iron ore through a dumper building and move specially-built cars filled with molten iron at the basic oxygen furnace reladling station onto the scale pouring platform. Scrap transfer vehicles move into position to have their loads emptied. None of these vehicles has anybody in the cab; they are operated by radio remote control.

For dumping coal or iron ore at the Burns Harbor plant, the radio controlled locomotives are coupled onto the loaded cars which have been delivered to a nearby receiving yard. Then, operated by ground personnel with portable pack radio transmitters, each locomotive pushes a train of loaded cars through a long thaw shed to the dumper building. As each train approaches the dumper building, its operator signals the dumper operator. The dumper operator then transfers control of the locomotive to an operating panel in the dumper control room. The cars are uncoupled when they enter the dumper by remote control. The dumper mechanism then empties each car and ejects it automatically.

As an empty car is ejected from the other side of the dumper building, it rolls by gravity toward a series of storage tracks. A radar system measures the exact speed of the car and compares the car speed to a predetermined speed. If the car is rolling too fast, an electric car retarder grips its wheels. When the car slows to the desired speed, (as measured by the radar unit), the retarder releases the wheels, and the car continues to the storage track. The release speed is adjusted so that the car will couple to the preceding car on the storage track just as it rolls to a stop. As the storage track fills up, the release speed automatically readjusts to compensate for the shorter distances the cars must roll.

At the dumper operation, control of the locomotive from the portable packset is not achieved by direct trans-

mission. The packset transmits to a receiver in the dumper building, where the signal is instantly retransmitted to the locomotive. If it is desired to control the locomotive by direct transmission, a key switch in the locomotive cab reprograms its address code to respond to the packset transmission.

The radio controlled locomotives, controlled by direct transmission from the packsets, are also used to move cars loaded with molten iron at the reladling station of the basic oxygen furnace onto the scale pouring platform. These "submarine" cars resemble giant thermos bottles and are capable of keeping molten iron in its liquid state for as long as 24 hours.

Three 900 hp diesel-electric switch engines and three self-propelled scrap transfer vehicles have been equipped for radio remote control. These vehicles can be operated by personnel standing on the ground using portable, tone-modulated FM radio transmitters, or by personnel operating fixed control panels at strategic viewing locations. These vehicles can also be operated manually by onboard personnel, if necessary.

In the locomotives, the radio equipment and relay interface are housed in a metal case mounted inside the cab. The antenna is mounted on the cab roof. The output of the relay interface operates the appropriate solenoid valves in the locomotive's control system. Four colored lamps on each side of the locomotive indicate operating status (i.e. power applied, brake cylinder pressure, forward and reverse). An emergency stop button on the side of the locomotive is readily accessible to personnel on the ground.

The encoder-transmitter unit, antenna and battery are in a case equipped with a backpack harness. The control switches are housed in a belt-supported box. Total weight of the man-carried equipment is less than 14 lb. Safety is ensured by two posture-sensitive "dead man" switches which would operate to bring the locomotive to a stop—after a predetermined delay—should the operator's position vary considerably from a normal, upright position.

Batteries for the portable equipment are plug-in, rechargeable units. Each battery unit has ample capacity for a normal 8-hr shift. At the end of the shift, the battery is placed on charge, and another inserted in its place. Normal charging time is 14 to 16 hours. Thus, three batteries are sufficient for round-the-clock operation.

DUMPER OPERATOR CONTROLS ENGINE pushing loaded cars into dumper.

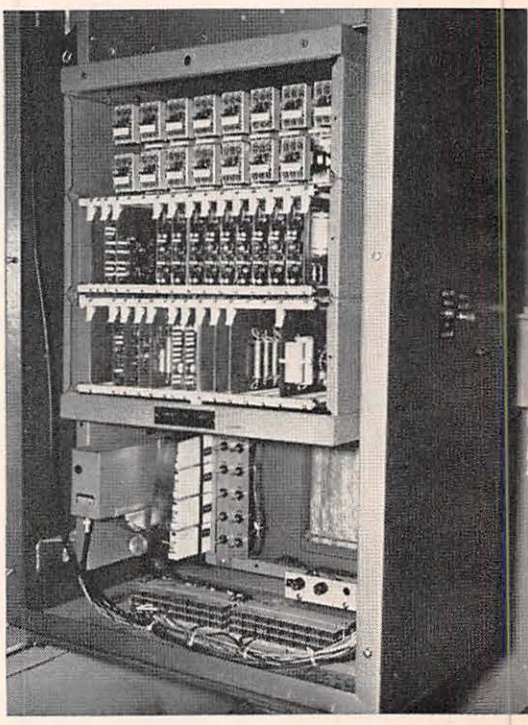
Where fixed transmitter locations are used, the transmitter is housed on a standard rack, the antenna mounted on a mast or on the roof of the building, and the controls are on a convenient panel at the operating position.

Remote control equipment and systems including the retarders at the Burns Harbor steel plant were designed and furnished by General Railway Signal Co.

At the basic oxygen furnace building, three specially-built scrap transfer vehicles move scrap metal from the scrap loading area to the furnaces. These vehicles are equipped for radio control in a similar manner as the locomotives. They are operated from control panels on two overhead cranes, or from a panel on the basic oxygen furnace charging floor.

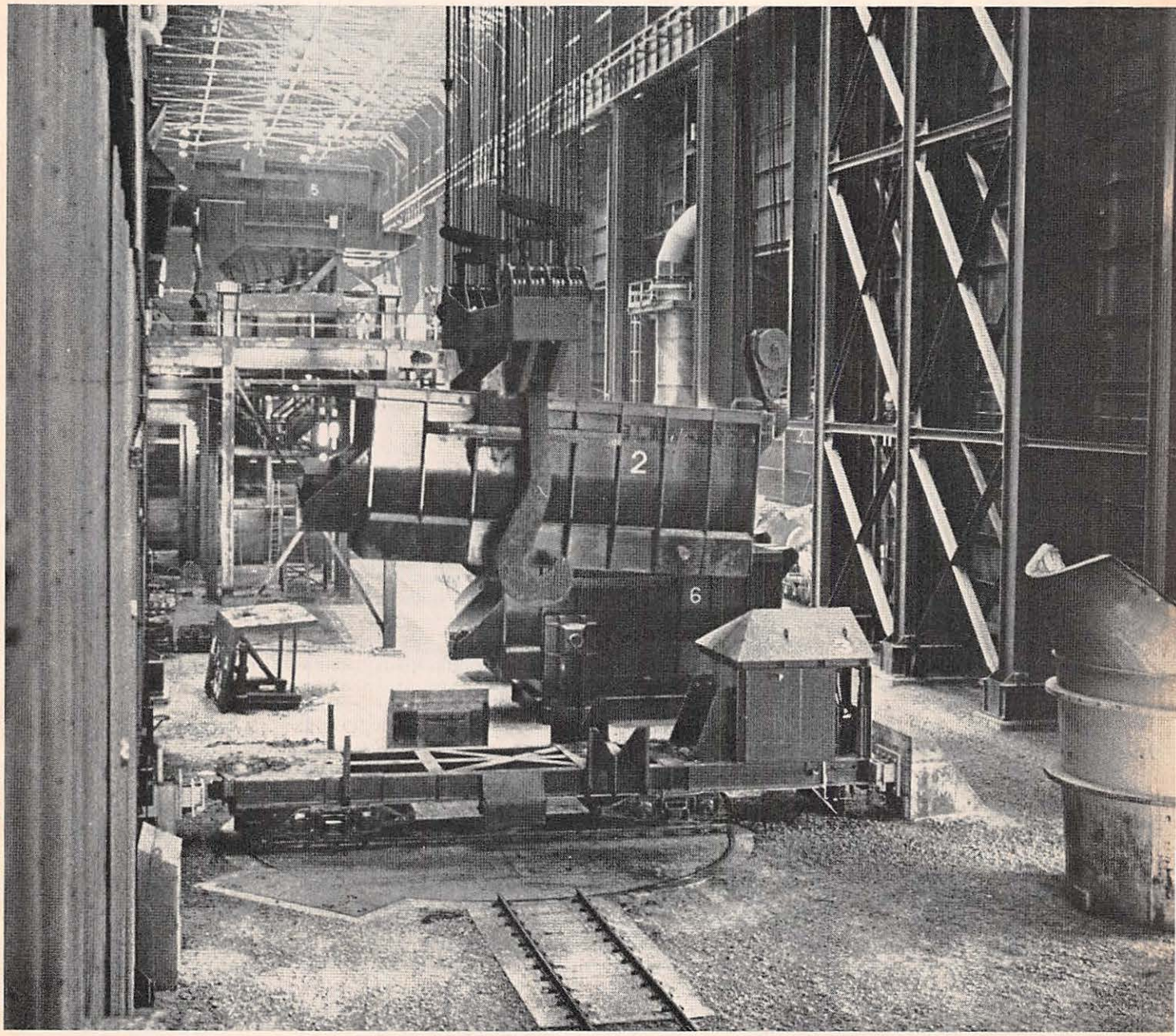
Scrap is loaded from gondola cars into the vehicles by the overhead cranes. When a vehicle is full, either of the two crane operators can then assume control of the vehicle by setting a switch on his control panel to the appropriate position. Once an operator takes control, the vehicle will respond only to signals from that operator until control is released. This allows several vehicles to be controlled simultaneously.

The scrap transfer car moves, under control of the crane operator, toward the charging floor. As it approaches the charging floor, a trip arm on the car contacts an actuator at trackside.



RADIO is in a case on scrap car.

This action changes the car's address code so that it now responds only to the operating panel on the charging floor. Under this control, the car moves onto a turntable, where it is rotated into position for the charging crane. This crane then lifts the body—resembling a huge sugar scoop—off the vehicle, leaving the cab and chassis behind. The body is carried to the basic oxygen furnace where scrap is poured into the furnace as needed.



CHARGING CRANE lifts body from scrap transfer vehicle and will tilt it to dump scrap into oxygen furnace.

GRS radio remote control systems have been placed in service by 12 companies engaged in such diverse activities as power generation, steel making, cement manufacture and mining. Users of GRS radio remote control systems for locomotives or other vehicles include: Alan Wood Steel Corp. (1 set); Bethlehem Steel Corp. (6 sets); Cleveland Quarries Co. (1 set); Erie Mining Co. (20 sets); Fundy Gypsum (1 set); Inland Lime & Stone (8 sets); Kennecott Copper Corp. (5 sets); Phelps Dodge Corp. (51 sets); Southern Peru Copper (11 sets); U.S. Steel Corp. (64 sets); Universal Atlas Cement (1 set); and Wisconsin Power & Light (1 set).

The GRS radio remote control system is capable of controlling as many as 128 vehicles, each up to 16 commands, simultaneously on the same radio frequency, without interference. Transmitting range is kept down to approximately ½ mile to further minimize interference. The 154 MHz signal is transmitted, in the form of random pulses, at the rate of one pulse during each 100 millisecond period of time. This technique practically eliminates the possibility of two simultaneously-transmitted pulses blocking one another.

Aside from economic advantages—one man operating a locomotive or vehicle—, users report that the improved efficiency and added safety of running trains by this means have exceeded expectations.

D&TSL has real-time computing

D&TSL DATA IS PROCESSED in real time and in batching on Univac 9300.

Detroit & Toledo Shore Line is proving that a small railroad can afford such space age controls as a realtime, on-line computer system. D&TSL, a 60-mile carrier operating between Detroit, Mich., and Toledo, Ohio, handles between 1,000 and 1,500 cars daily. To improve its efficiency and obtain better control of its operations, D&TSL is using a UNIVAC 9300 computer that handles both batch processing and teleprocessing. At present, four Teletype model 28 terminals are connected to the computer at all times. A fifth unit on-line at night only, provides AAR's TRAIN system with D&TSL interchange data.

One of these computer terminals is located in the office of the retarder classification yard at Toledo to transmit and receive train consists. This data is stored on the computer's memory disks and batch-processed periodically to produce car accounting records for accounts receivable.

A terminal is in the yard office/freight agency at the Edison station, Trenton, Mich., about 35 miles away. This terminal sends and receives consists, and transmits waybills to Toledo to cover cars received at the hump before billing.

The third terminal is in the traffic department in Detroit, where D&TSL has executive offices and a receiving and delivery yard. This terminal primarily receives copies of outbound consists for customer tracing purposes; plus waybills, agency reports, and the like. Also, the terminal will soon be used for management inquiry.

A terminal is also located in the Grand Trunk Western data center in Detroit because both roads operate inter-railroad through freight train runs over each other's lines. This terminal sends and receives advanced train consists. As these are channeled through the UNIVAC 9300 it automatically explodes and reassembles them so GTW receives its consists in its format and D&TSL receives its consists in its format.

"Despite the small size and low cost ($4,000 a month) of the UNIVAC system, this is true multi-processing operation in that our conventional batch data processing and the on-line communications network operate at the same time. Jobs on the system include accounts receivable, with car accounting; accounts payable; payroll; stores inventory; depreciation; taxes; mechanical billing; a monthly traffic report, both for the month and year-to-date, set up geographically by customer, including the origin and destination points; and a monthly pool-car utilization report on our specialized equipment which is cataloged in the computer. When a car shows no utilization, its number is flagged by an asterisk," states Clayton V. McPhail, general manager, D&TSL.

The system also automates government reporting, including quarterly commodity statistics, employee service and compensations, and car service reports. I. E. Black, manager of systems and procedures, is working to mechanize freight agency accounting. In the past, Grand Trunk has performed joint agency accounting for D&TSL. "However, we will handle our own automatically on the computer and greatly reduce the clerical work required," says McPhail.

"The system now provides, on a more-current basis, information on car accounting, utilization, and distribution; agency accounts; cash flow; gross revenue, etc. The next step, and Black's major project at present is to make increasing amounts of this information available to management on a real-time basis. My office, for example, adjoins the Traffic Department where one of the computer terminals is located. By this Fall, we expect to receive at the terminal, via inquiry, gross revenue *by day* in relation to expenses for the day. This will permit closer and tighter management control than ever before possible, of course. Similarly, if we wish, we can even get our profitability by train, based on the number of cars, commodities hauled, etc."

A third-generation system, the 9300, has 16,000 positions of memory, three tape drives, two random-access magnetic memory disc drives, and a DCS 4 Communications Subsystem which links the computer to the terminals. Each terminal is equipped with an Oneida CAE translator which converts the Hollerith punch card code to Teletype terminal "language" which is then transmitted over telephone lines to the 9300.

D&TSL operates so that the communications program is the master program and data processing is under its control. The communications program checks itself every one second and if there is activity on the network to process, it does so. If not, it continues with data processing. Despite this frequent checking, data processing is never interrupted for more than three seconds at a time, once a minute, and only that much if there is communications activity to process. This brief delay is necessary because the small size of the computer's memory requires that it occasionally shift the storage location of programs from the processor memory to the discs and back. "If we expanded the computer's memory to 24,000 positions we wouldn't need to do this. But the delay is not significant enough to warrant increased rental costs.

"In summary, we find that today the same advanced tools of automation are available to the small railroad as to the large, at a price with which the smaller road can live. Thus, it behooves us to take advantage of these tools and achieve the tight control they make possible—if only to stay even with the game in the face of inflationary pressures," McPhail says.

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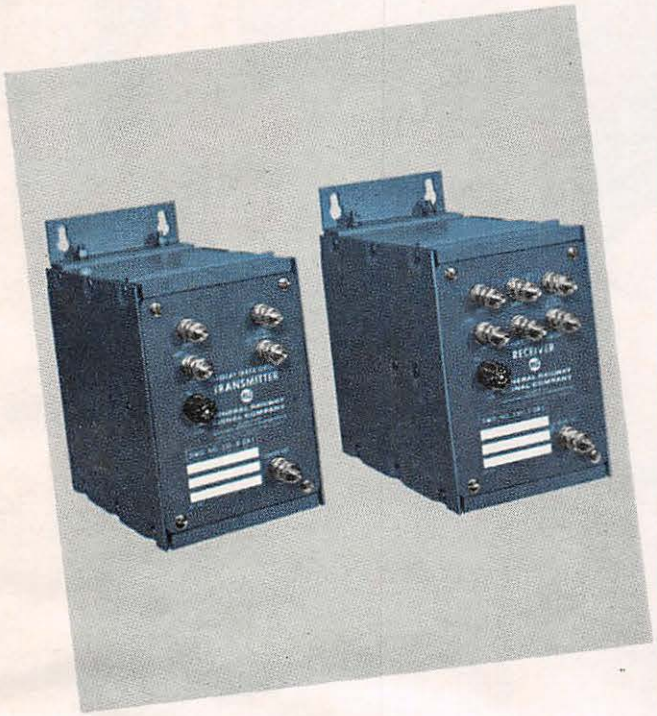

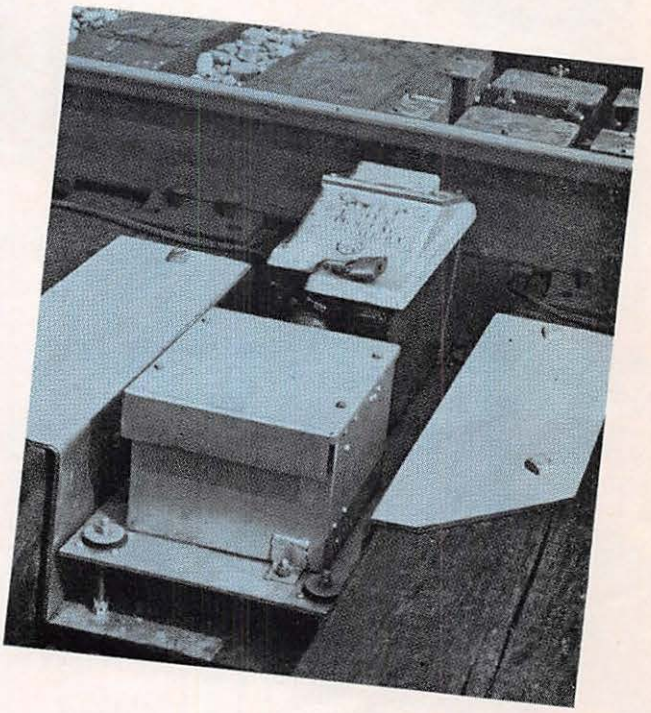

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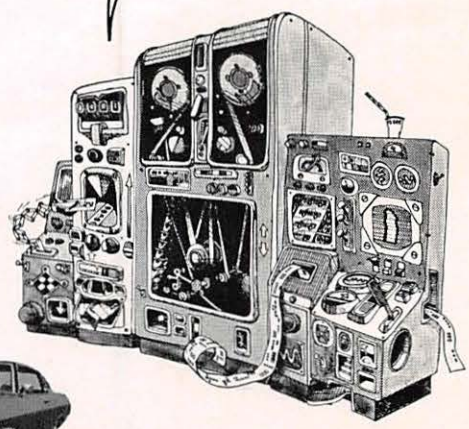

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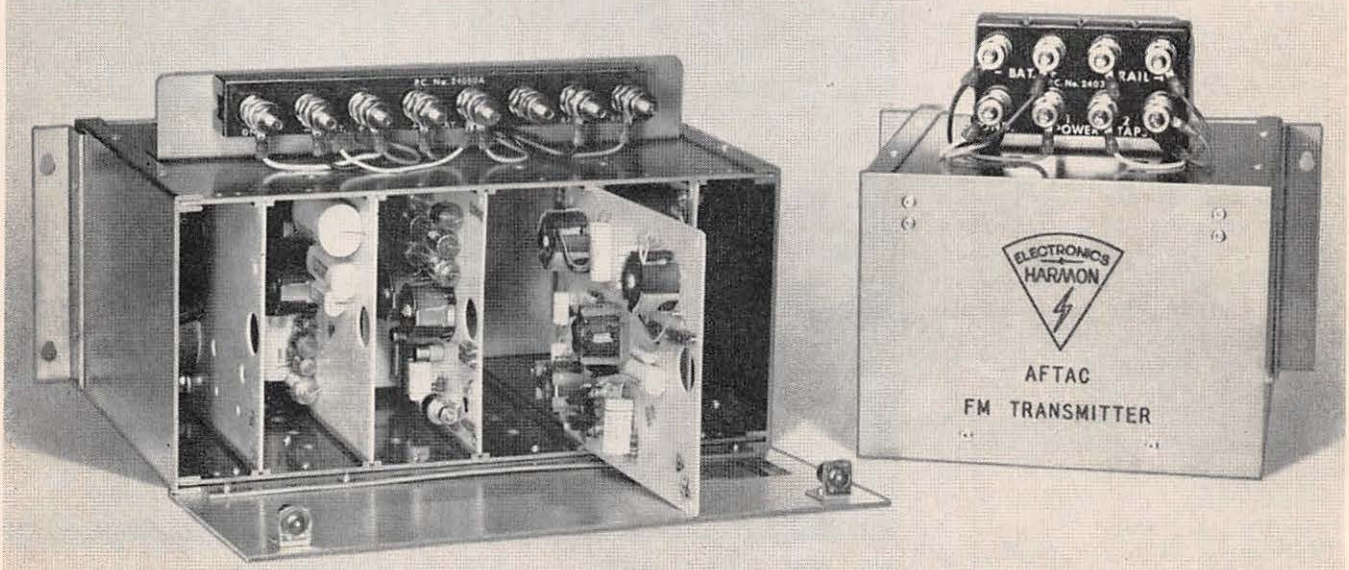

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Circle 11 on reader service card

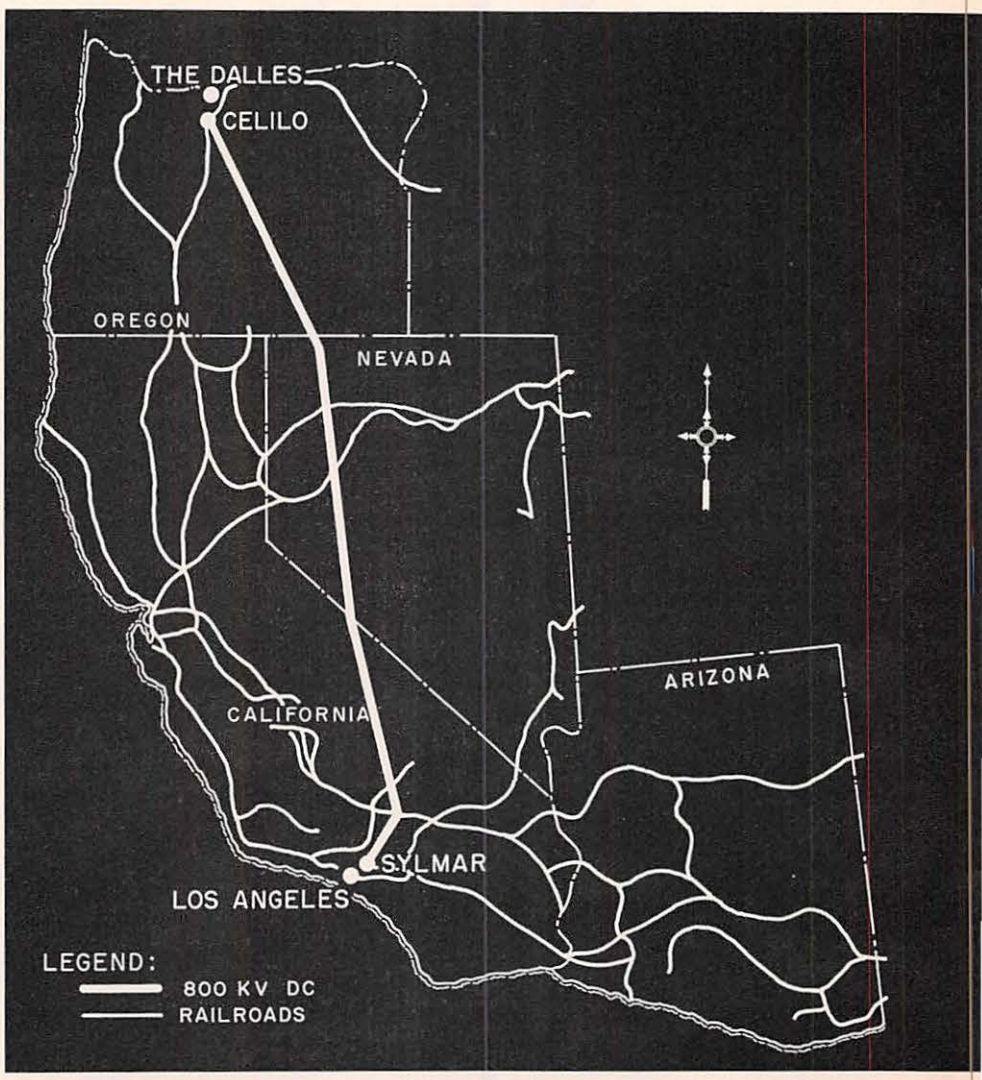
HVDC transmission may cause inter

BY HUGH M. ROBERTSON
ASSISTANT TO SUPERINTENDENT
COMMUNICATIONS
UNION PACIFIC

The Bonneville Power Administration (BPA) and the Los Angeles Water and Power District (LAWP) have constructed a high-voltage direct current transmission line from Celilo, Ore., approximately 7 miles southeast of The Dalles to Sylmar, Calif., approximately 20 miles north of Los Angeles in the San Fernando Mountains, a total distance of 853 miles.

This line operates in a bipolar mode at 400,000 volts positive and 400,000 volts negative potential, with a grounded center-tap at each end. Therefore, at either converter station one conductor will be 400,000 volts positive and the other conductor will be 400,000 volts negative in relation to ground. Between the two conductors, the voltage will be 800,000 volts, and the current will be 1800 amperes in each conductor. In the event of trouble, or during maintenance work on one conductor, the converters/inverters are so arranged that either one will operate in a monopolar mode. In this mode, the entire current of 1800 amperes flows through the ground. Also, the converters/inverters are arranged so that either end can be transmitting power while the other end is receiving power, permitting power to be "wheeled" either from North to South or from South to North.

This method of power transmission has many advantages from the standpoint of the power engineer who expects to transfer large blocks of power from one area to another, as losses due to line reactance are eliminated and synchronization between systems is no longer a problem. There is no question that the use of lines of this type will expand as the power requirements of this country expand and the public continues to resist the construction of fossil and nuclear fueled generating plants in urban areas, which in effect means that the power plants of the future will be constructed in remote areas where the fumes from fossil plants or the hazard from accidental release of radiation will have the least effect on the ecology of the area.



HVDC LINE RUNS 853 MILES from Celilo, Ore. to Sylmar, Cal.

The final result can only be the transmission of huge blocks of electric power by overhead DC transmission lines. The potential savings of HVDC transmission are tremendous. Now that a line has been built in this country successfully transmitting DC power, a tremendous upsurge of this type construction in this country is assured.

A recent study of AC transmission versus DC transmission gave the following results:

- A 230 Kv AC transmission line 300 miles long is capable of transmitting 275,000 KW at a cost of .249 mills per kilowatt mile.
- A 500 Kv AC transmission line 600 miles long is capable of transmitting 1,000,000 KW at a cost of .162 mills per kilowatt mile.
- A 750 Kv DC transmission line 900 miles long is capable of transmitting 1,200,000 KW at a .131 mills per kilowatt mile or almost half the cost for a 230 Kv AC transmission line per kilowatt mile.

Editor's Note: Paper presented at 10th Annual Meeting, Communication & Signal Section, AAR, San Francisco, Calif., Sept. 17, 1970. (Also, see Railway System Controls, July, 1970, pages 18-20.)

ference to communications circuits

MANAGEMENT INFORMATION

A high-voltage, direct-current transmission line, constructed in the western United States, operates at 800,000 volts and carries 1800 amperes current. Tests made on the 853-mile line indicate that serious interference does exist in the portion of the spectrum 3 KHz to 150 KHz. In the portion between 3 KHz and 124 KHz, the converter/inverter stations were generating noise of considerable magnitude into railroads' communication facilities. Very little effect was noted from those frequencies above 124 KHz. Further, little effect was noted in the frequency range 0 KHz to 3 KHz.

Railroad communication facilities using superimposed carrier techniques normally operate in the range 4 to 150 KHz; therefore, the noise being generated by the Celilo converter/inverter station falls directly within the operating range of the railroad's carrier derived communications systems.

The carrier systems affected are utilized for voice transmission, dispatchers' telephones, for analog data, i.e., hotbox detectors and other systems of this type and digital data, i.e., teleprinter circuits, centralized train control coding equipment, and systems of this type.

We in the west are already faced with many 500,000-volt AC transmission lines. At a recent meeting of the Institute of Electrical and Electronic Engineers in New York, it was predicted these DC transmission line voltages would increase to 1,300,000 volts and power to 10,000 megawatts. I am certain you all realize the problems these developments will present to the signal and communications engineer.

Two distinct problems result from a high-voltage, direct current line to railroad facilities, namely inductive and cathodic. The inductive problems are those voltage components generated by the converters in transformation of AC to DC and back again, which by various methods of coupling, result in noise being impressed on communications or signal facilities. The cathodic problems are those which occur due to ground potential changes resulting from large current flows through the earth. The two problems, although somewhat related, differ entirely in the application of corrective measures.

Subsequent to a seminar held by the AAR Communications and Signal Section in Denver, November 1966, two groups were organized to study the various problems associated with this HVDC line. A cathodic group, which included the pipeline organizations, railroads, and communication companies, later employed Ebasco Corp. to coordinate their various test programs and furnish a consolidated report. The other group formed to study the inductive problems was known as the Subcommittee on Inductive Coordination Studies, chaired by George Elder of Los Angeles Water and Power Department.

The inductive problem and the current status of this program is as follows: During the month of May, 1969, LAWP held a series of tests utilizing a 5 KW audio tone generator operating between the frequencies of 360 Hz and 5040 Hz. These signals were impressed on the HVDC conductors at a predetermined frequency and voltage for all interested parties to observe in their facilities. At three locations LAWP built test telephone lines 1 kilometer long and 1 kilometer distant parallel to the HVDC line. As a result of the data obtained from the test lines and the considerable data furnished by the railroads and communications companies, a meeting was held in Los Angeles by the full committee. The LAWP and BPA arrived at the conclusion that "discretion was the better part of valor", and agreed to install additional audio filtering in the DC line, as well as filtering in the AC lines supplying the converters. This filtering was installed and the line has been energized intermittently beginning in December 1969 until the full scale harmonic tests made in June 1970 for the contractors to optimize the filtering arrangement and properly adjust the firing angles of the converters.

Also, as a result of the audio tests in May 1969, LAWP decided, due to the radio interference emanating from the converters, to install a Farraday screen or shield enclosing the entire converter station, an area of approximately 6 acres. I visited this station after the screen was built and if, for any reason, the DC line is abandoned, it will make the world's largest aviary.

No Farraday shield or screen was installed at the Celilo terminal as BPA felt that due to the isolated area where the converter is located, it would not be necessary.

During March of this year LAWP and BPA performed acceptance tests on the equipment, using various voltages and currents intermittently. The specification for harmonic induction in the audio range was based on a criteron that no interfering signal should result in the three one-kilometer test lines of over 10 millivolts. Bell Telephone members agreed this would be an acceptable limit. The railroad members on this committee are on record, however, of accepting no given limits other than the effects in their own facilities.

Regrettably no consideration was given to interference which might result in the carrier portion of the spectrum, that is, the portion of the frequency spectrum from 3 KHz to 150 KHz. It has been determined that serious interference does exist in this portion of the frequency spectrum.

It is probable this carrier interference is the result of noise being generated in the converters/inverters being fed back into the AC primary feed to the converters/inverters. It was hoped sufficient tests could be made during the period May 31 through June 7 to obtain sufficient meaningful data to determine if this assumption was correct. However, this was impossible due to the reluctance on the part of BPA to shut down sufficient of the AC lines feeding the converters to draw meaningful conclusions.

During the period May 31 through June 7, 1970, harmonic measurements were made by the Union Pacific, the Burlington Northern (formerly SP&S railway property), and the BPA to determine the magnitude of interference to railroad communication facilities as

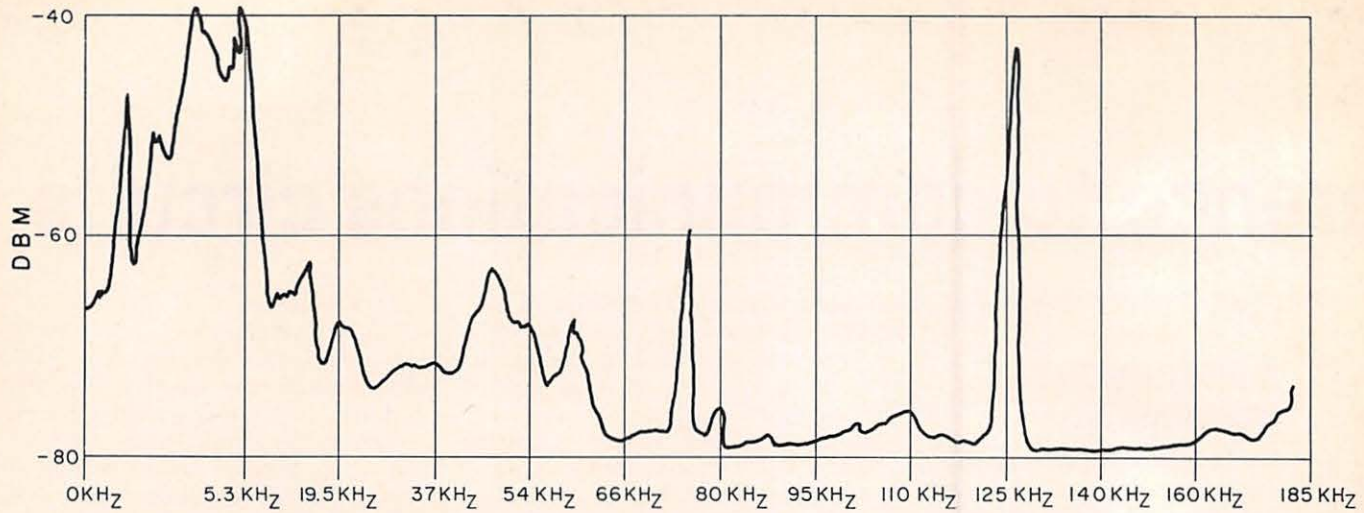


CHART A-1: Measured circuit No. 76 westward at The Dalles, Ore.; 85 miles No. 9 copper. Test was made 6/5/70 at 4:00 am. HVDC line transmitting 1440 megawatts south to north. Weather was clear.

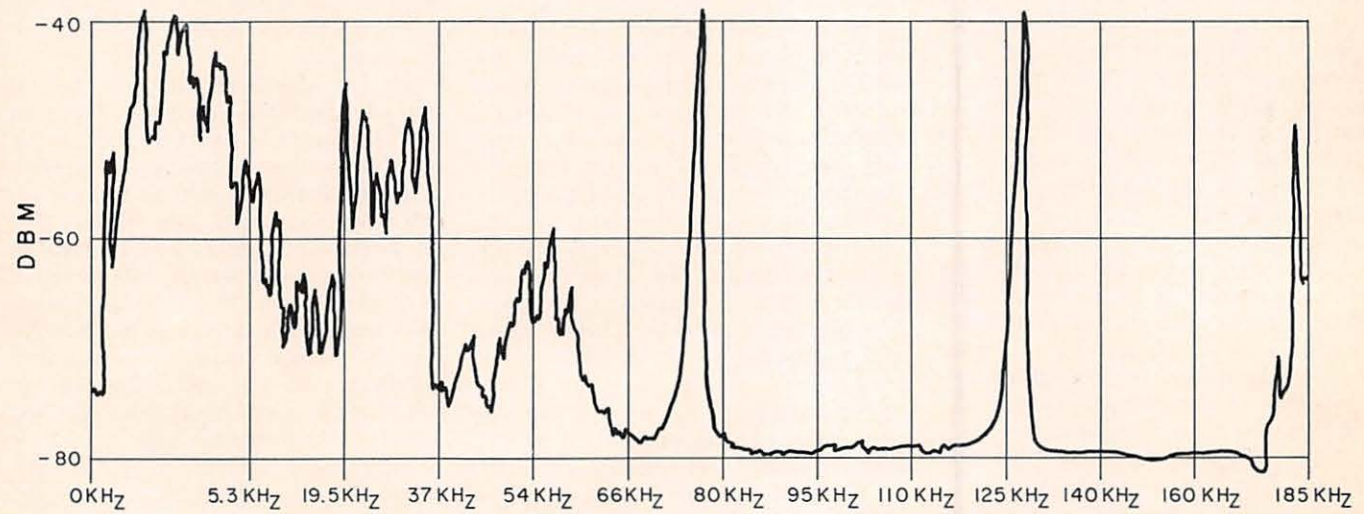


CHART A-2: Measured circuit No. 76 westward at The Dalles, Ore.; 85 miles No. 9 copper. Test was made 6/5/70 at 5:27 am. HVDC line transmitting 1440 megawatts south to north. Weather was clear.

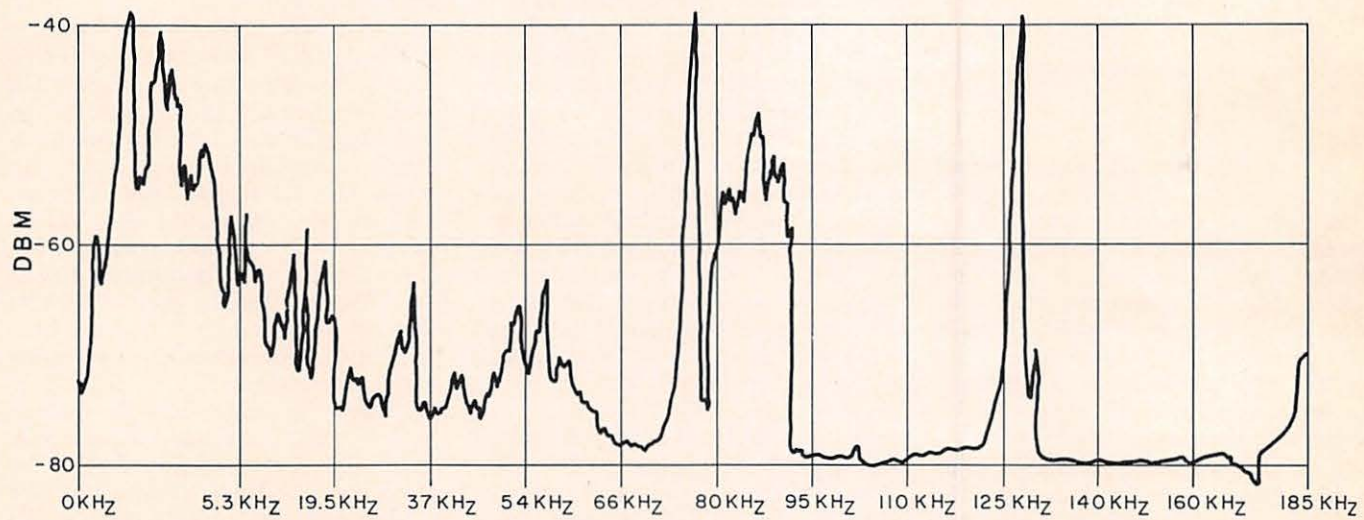


CHART A-3: Measured circuit No. 76 westward at The Dalles, Ore.; 85 miles No. 9 copper. Test was made 6/5/70 at 5:33 am. HVDC line transmitting 1440 megawatts south to north. Weather was clear.

a result of the operation of the HVDC line between Celilo, Ore. and Sylmar, Calif.

A meeting was held by all parties concerned on May 28, 1970, at the BPA building in Portland, Ore. to discuss the technique and procedures to be used in making tests to determine magnitude of power line interference. It was agreed at that time two BPA engineers would accompany Union Pacific and Burlington Northern personnel during these tests to observe and resolve any questions as to the method or techniques used in making the tests to avoid any differences which might develop later as to how the tests were conducted. Representatives of BPA were present as planned and they have been furnished copies of all the test data obtained.

A Singer spectrum analyzer equipped with a sychronized "X-Y" recorder was utilized to obtain the test data. The analyzer was calibrated to sweep the frequency range 0 to 185 KHz and further calibrated to indicate level readings between minus 40 dbm and minus 80 dbm. A number of charts were obtained showing magnitude of interference to communication circuits under various loads on the HVDC power line. Measurements were made with electric power being transmitted both in the north-to-south and in south-to-north direction. Charts were also made with the Celilo converter/inverter station disconnected from the HVDC line; however, at no time were we able to obtain tests with the converter/inverter station disconnected from the AC feeder lines, as BPA indicated a test of this kind would require switching of too great a magnitude on their part.

These tests indicated that in that portion of the frequency spectrum between 3 KHz and 124 KHz the converter/inverter stations were generating noise of considerable magnitude into railroads' communication facilities. Very little effect was noted from those frequencies above 124 KHz. Further, little effect was noted in the frequency range 0 KHz to 3 KHz.

Railroad communication facilities using superimposed carrier techniques normally operate in the range 4 to 150 KHz; therefore, the noise being generated by the Celilo converter/inverter station falls directly within the operating range of the railroad's carrier derived communications systems.

The carrier systems affected are utilized for voice transmission, dispatchers' telephones, for analog data, i.e., hotbox detectors and other systems of

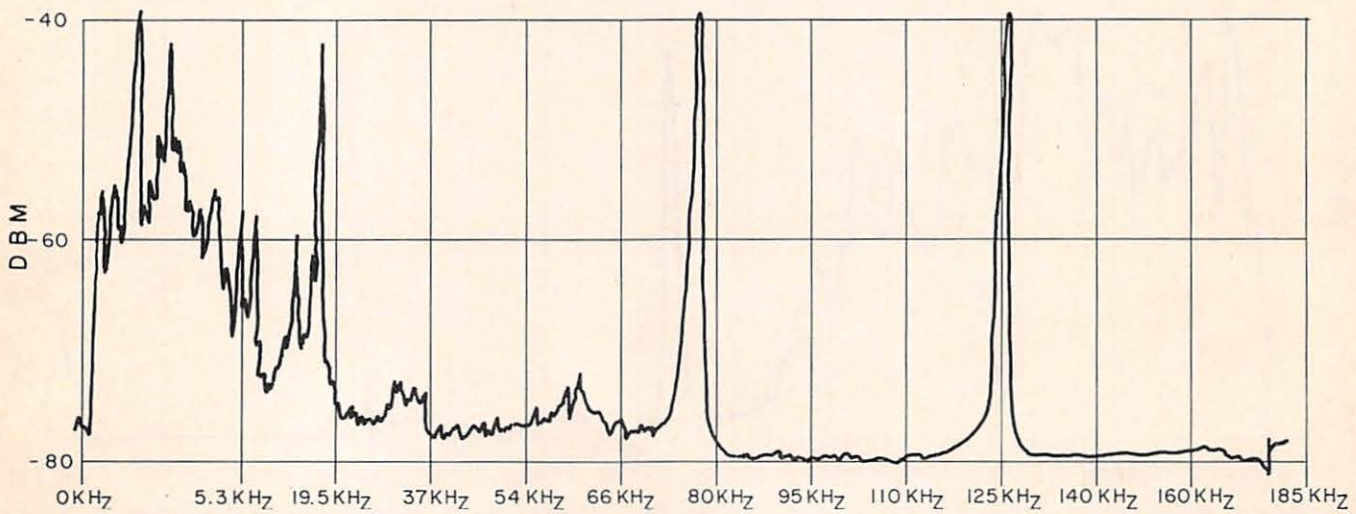


CHART A-4: Measured circuit No. 76 westward at The Dalles, Ore.; 85 miles No. 9 copper. Test was made 6/5/70 at 7:00 am. HVDC line was not transmitting any power. Weather was clear.

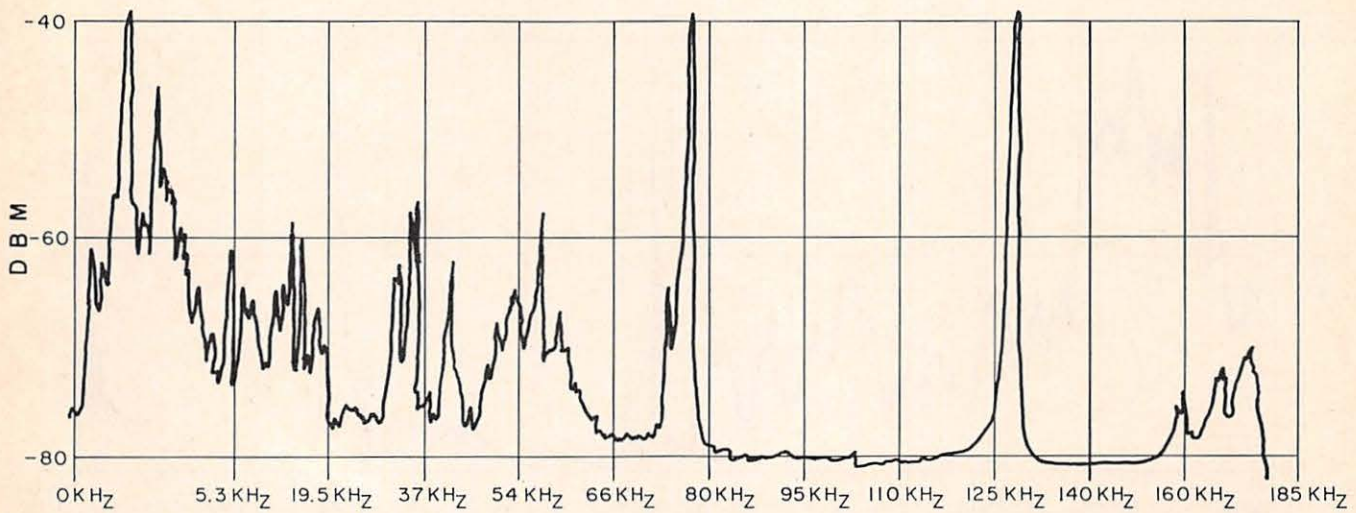


CHART A-5: Measured circuit No. 76 westward at The Dalles, Ore.; 85 miles No. 9 copper. Test was made 6/5/70 at 2:10 pm. HVDC line was transmitting 900 megawatts north to south. Weather was clear.

this type, and digital data, i.e., teleprinter circuits, centralized train control coding equipment, and systems of this type. The reliable operation of these circuits, particularly with reference to data, both analog and digital, is dependent upon having a signal to noise ratio adequate to provide error free transmission. The voice circuits involved can withstand a greater degree of noise and still be operable, depending on how much noise the user will tolerate; however, the accepted industry standard for voice circuits is 20 dbrnc0.

The tests made indicated increases in noise levels of as much as 30 db within the carrier frequency portion of the spectrum; however, the resultant noise was erratic, apparently dependent entirely on the power load and firing angles of the valves in the converter/inverter station. Where an extreme amount of noise was found at one frequency, a few seconds later noise of this same magnitude would appear at another frequency, which creates a condition of random noise across the entire spectrum. As the frequency increased, the noise tended to decrease in most conditions; however, at some times, the noise would be much greater in the higher frequency end of the spectrum.

It was determined from these tests that the greatest interference (noise conditions) to the communication facilities existed during a period of changing load on the HVDC line from a high current load to no load or vice versa. During these periods, the firing angles of the converters are apparently quite erratic and large increases of noise resulted throughout the spectrum, particularly in the low end of the spectrum between 3 and 10 KHz. The noise generated from the Celilo station appeared on all communication facilities, both east and west of The Dalles and on the Bend branch. The pattern of the interference to the Union Pacific facilities followed almost exactly the pattern of the interference to the Burlington Northern circuits east and west

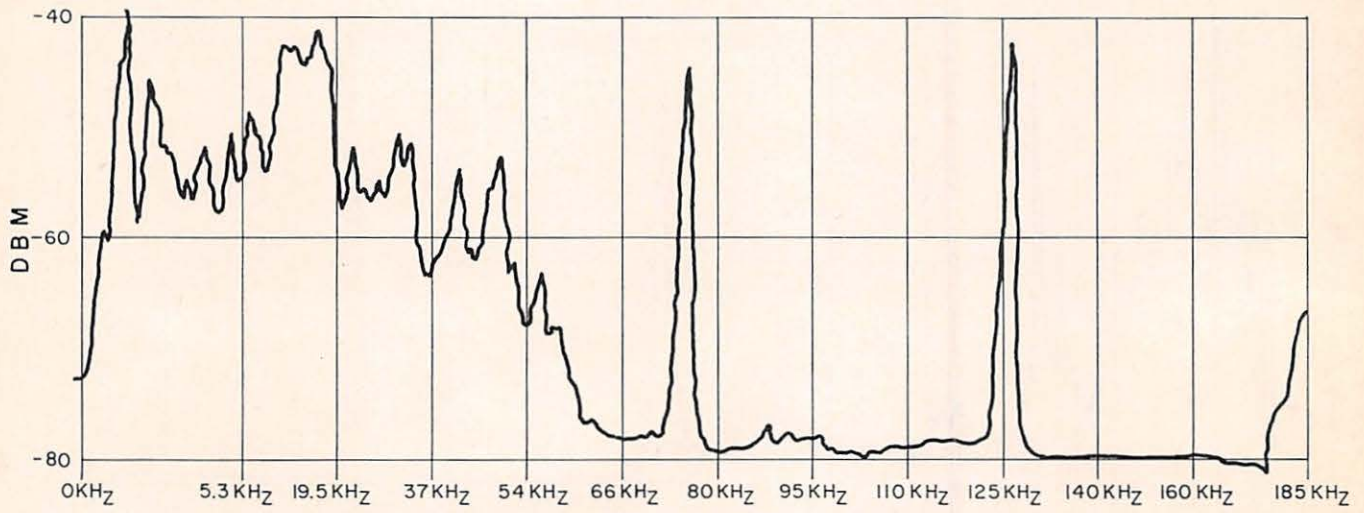


CHART B-1: Measured circuit No. 76 eastward at The Dalles, Ore.; 100 miles No. 9 copper. Test was made 6/5/70 at 4:00 am. HVDC line was transmitting 1440 megawatts south to north. Weather was clear.

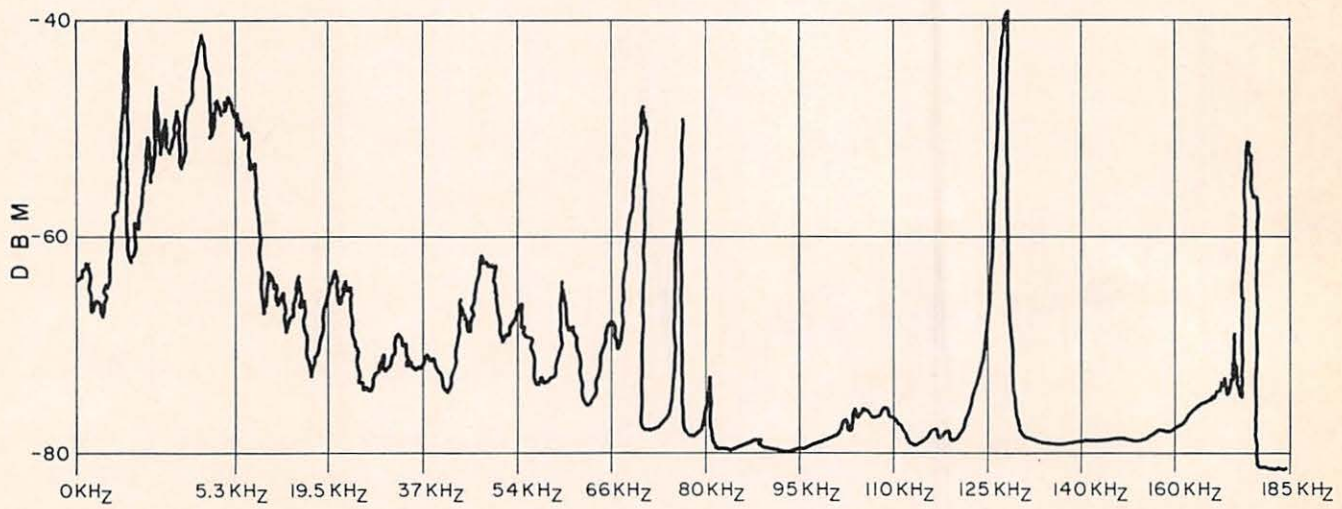


CHART B-2: Measured circuit No. 76 eastward at The Dalles, Ore.; 100 miles No. 9 copper. Test was made 6/5/70 at 5:25 am. HVDC line was transmitting 1440 megawatts south to north. Weather was clear.

from Wishram, Wash., and to Bend, Ore.

Series A charts were all made on June 5, 1970, which date was during the 8-day harmonic test period for the Celilo-Sylmar HVDC line. These charts indicate the magnitude and scope of the interfering noise to the Union Pacific circuit No. 76 west. This communication circuit consists of a pair of No. 9 AWG copper wires, carrier transposed, extending 85 miles between The Dalles and Portland, Ore.

Chart A-1 indicates the magnitude and scope of the interference to this line at 4:00 am when the HVDC line was operating with a 1440 megawatt load south to north transmission.

Chart A-2 was made at 5:27 am. It will be noted that a marked increase in noise in the 19.5 KHz to 35 KHz segment took place. Also, an increase in noise in the vicinity of 60 KHz.

Chart A-3 taken at 5:33 am, indicates the noise interference as the output of the Celilo converter/inverter station was being reduced in power for the anticipated 6:00 am shutdown. It will also be noted that there was an increase in noise between 80 KHz to 90 KHz.

Chart A-4, made at 6:35 am, indicates the magnitude of the noise on the communication line when supposedly a no-power situation existed on the HVDC line; however, the Celilo converters/inverters were still being energized from the AC feeder lines. The several spikes or high noise points were found to be from telemetering tones on other AC lines in the area operating at 15 KHz, 75 KHz and 125 KHz.

Chart A-5 indicates the noise interference on the line at 2:10 pm with the HVDC line operating with a 900 megawatt load transmitting from north to south. It will be noted a very marked increase of noise resulted from 5.3 KHz to approximately 60 KHz, as well as an increase in noise in the area 160 KHz to 180 KHz.

Series B of charts were made on Union Pacific 76 east circuit consisting

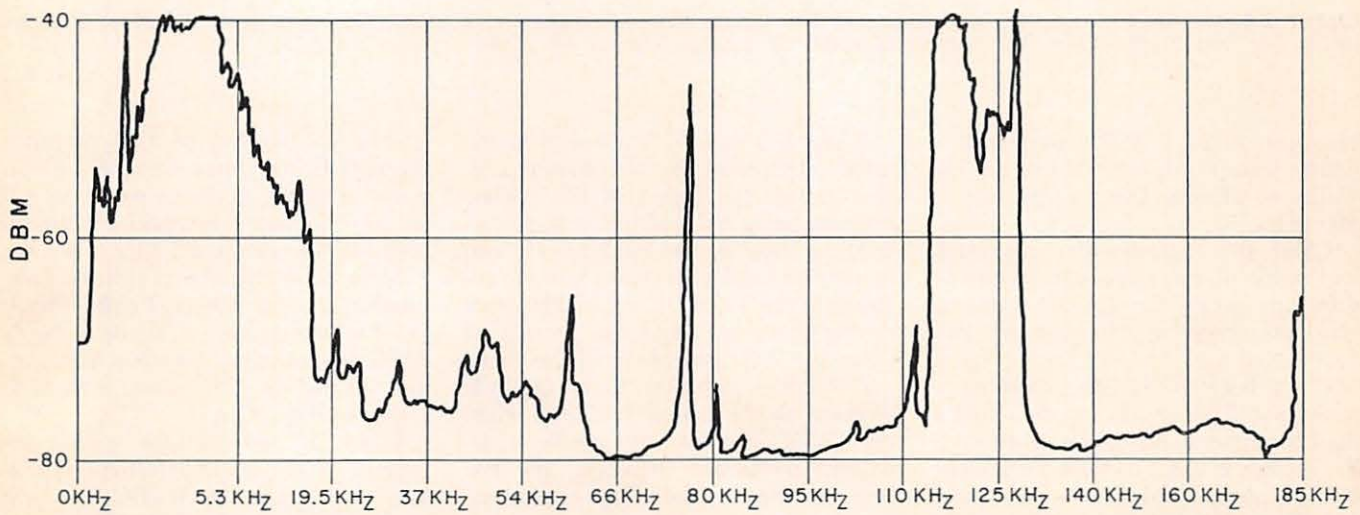


CHART B-3: Measured circuit No. 76 eastward at The Dalles, Ore.; 100 miles No. 9 copper. Test was made 6/5/70 at 5:31 am. HVDC line was transmitting 1440 megawatts south to north. Weather was clear.

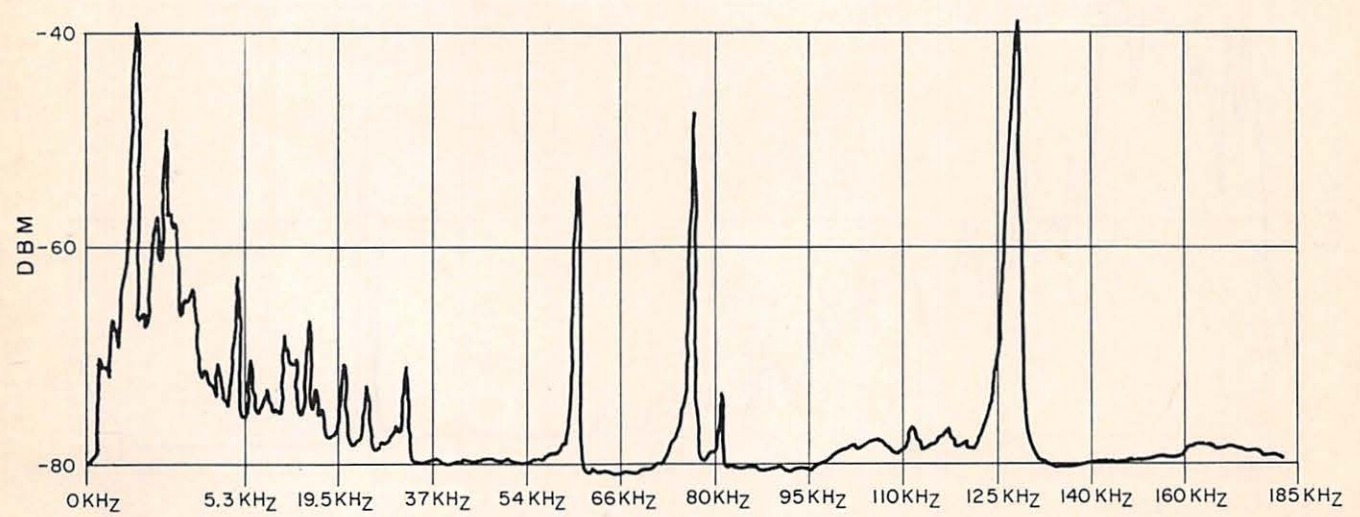


CHART B-4: Measured circuit No. 76 eastward at The Dalles, Ore.; 100 miles No. 9 copper. Test was made 6/5/70 at 6:35 am. HVDC line was not transmitting any power. Weather was clear.

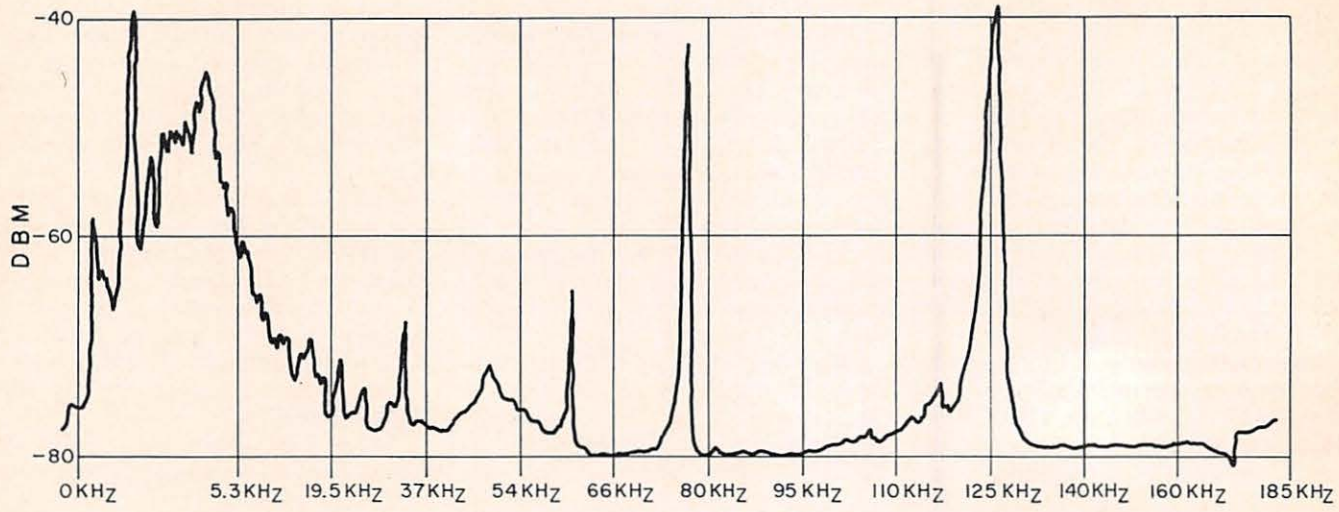


CHART B-5: Measured circuit No. 76 eastward at The Dalles, Ore.; 100 miles No. 9 copper. Test was made 6/5/70 at 2:17 pm. HVDC line was transmitting 900 megawatts north to south. Weather was clear.

of a pair of No. 9 AWG copper wires, carrier transposed, extending from The Dalles to Hinkle, Ore., a distance of 100 miles.

Chart B-1 indicates the magnitude and scope of the noise interference at 4:00 am, when the HVDC line was transmitting with a 1440 megawatt load south to north.

Chart B-2 indicates the noise interference at 5:25 am. It will be noted a marked increase in noise resulted in the portion of the spectrum 3.5 KHz to 6 KHz, and a reduction in noise from 6 KHz to 54 KHz with an increase again between 60 KHz and 80 KHz.

Chart B-3 at 5:31 am indicates the noise interference on the communication line as the power in the HVDC line was being reduced for the expected 6:00 am zero power condition. It will be noted a marked increase in noise resulted in the 110 KHz to 125 KHz area during this period and the increase of noise at 4 KHz went beyond the chart.

Chart B-4 indicates the magnitude of noise on the line at 6:35 am, when the HVDC line was supposedly transmitting no power; however, the AC was energized to the Celilo converter/inverter station.

Chart B-5 indicates the noise interference on the line at 2:17 pm with the HVDC line transmitting 900 megawatts of power north to south. It will be noted a marked increase in noise resulted in the spectrum 3 KHz to 6 KHz.

Series C of charts indicates the noise interference on Union Pacific circuit OT-6 which consists of a pair of No. 9 AWG copper wires, transposed for carrier, extending 150 miles from The Dalles to Bend, Ore.

Chart C-1 indicates the noise interference on the communications line at 4:17 am, when the HVDC line was transmitting at a load of 1440 megawatts south to north.

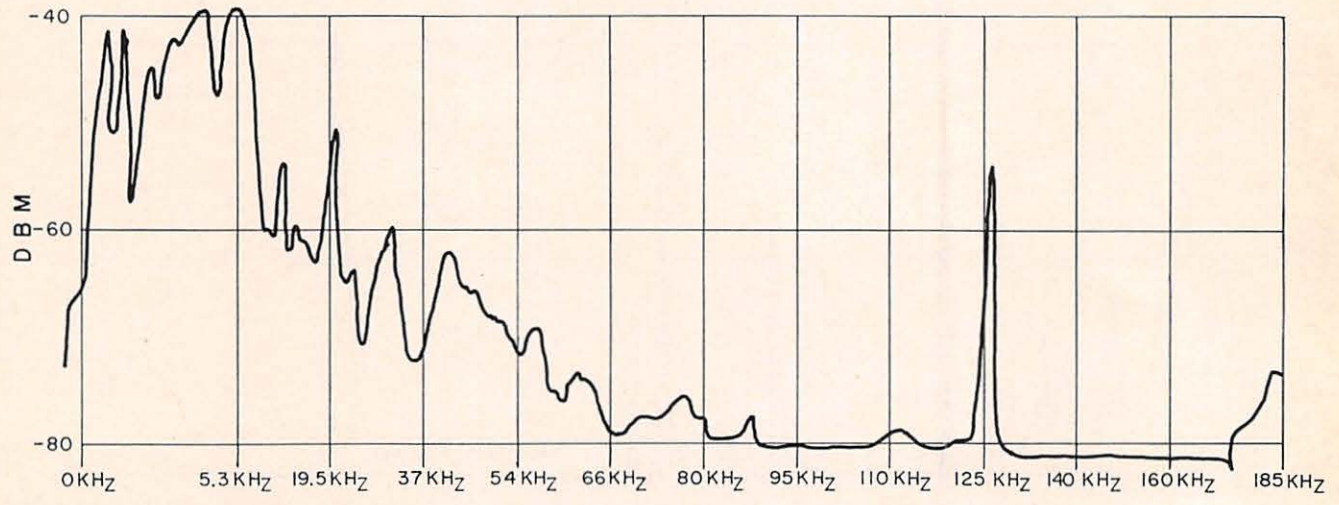


CHART C-1: Measured circuit No. OT-6 southward at The Dalles, Ore.; 150 miles No. 9 copper. Test was made 6/5/70 at 4:17 am. HVDC lines transmitting 1440 megawatts south to north. Weather was clear.

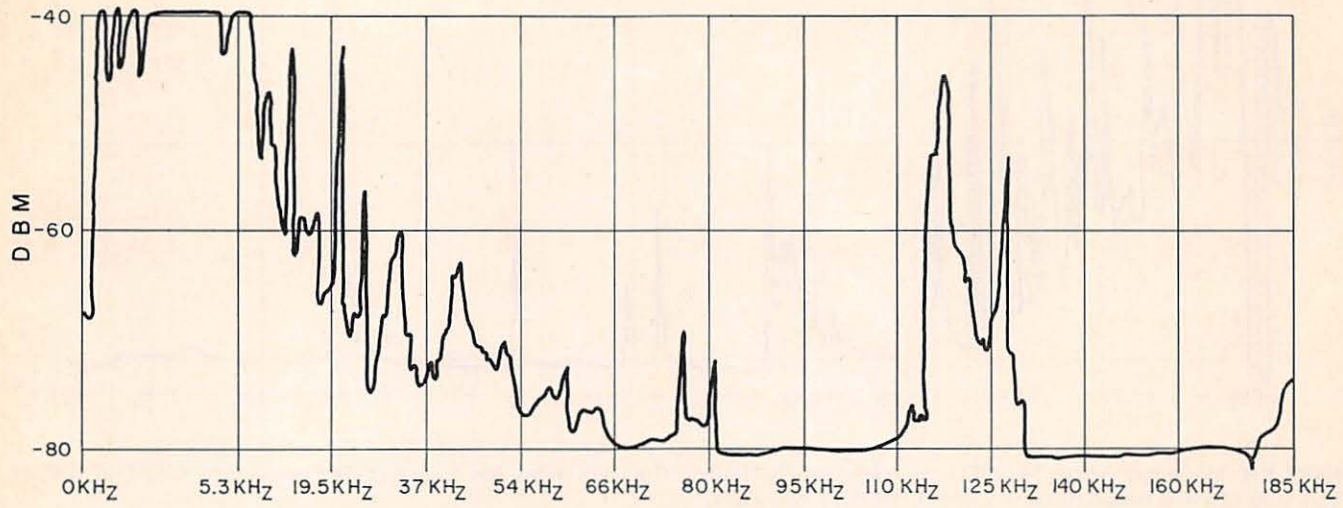


CHART C-2: Measured circuit No. OT-6 southward at The Dalles, Ore.; 150 miles No. 9 copper. Test was made 6/5/70 at 5:29 am. HVDC line transmitting 1440 megawatts south to north. Weather was clear.

Chart C-2 indicates the interference on the line at 5:29 am, just prior to the HVDC line power being reduced for the scheduled 6:00 am, zero power condition. It will be noted a marked increase in noise resulted from 3 KHz through 7 KHz, of a level higher than a minus 40, also a marked increase in noise resulted from 112 KHz to 125 KHz.

Chart C-3 at 6:03 am, indicates the interference when the power being transmitted on the HVDC line has supposedly been reduced to a very low level. You will note the large increase in noise in the area of 54 KHz to 60 KHz during this period.

Chart C-4 indicates the interference on the line at 6:40 am, when the DC line had supposedly been reduced to zero power; however, the AC input to the Celilo converter/inverter was still connected.

Chart C-5 indicates the interference on the line at 2:05 pm when the DC line was operating at 900 megawatt load north to south. It will be noted a large increase in noise in that portion of the spectrum 3 KHz to 5.3 KHz resulted.

Chart C-6 indicates the interference on the line at 2:40 pm with a 900 megawatt load being transmitted north to south. At this time, the Big Eddy-McNary 230 Kv line had been deenergized to determine if this was contributing to the interference on the circuit. However, it will be noted very little improvement resulted.

Also, during the 8-day harmonic measurement period for tests between Sylmar, Calif. and Celilo, Ore., the Southern Pacific made tests on a telephone pair 3.5 miles long, approximately three-fourths miles north of the Sylmar power station at this location. A parallel exists between the HVDC line and the Southern Pacific circuit for a

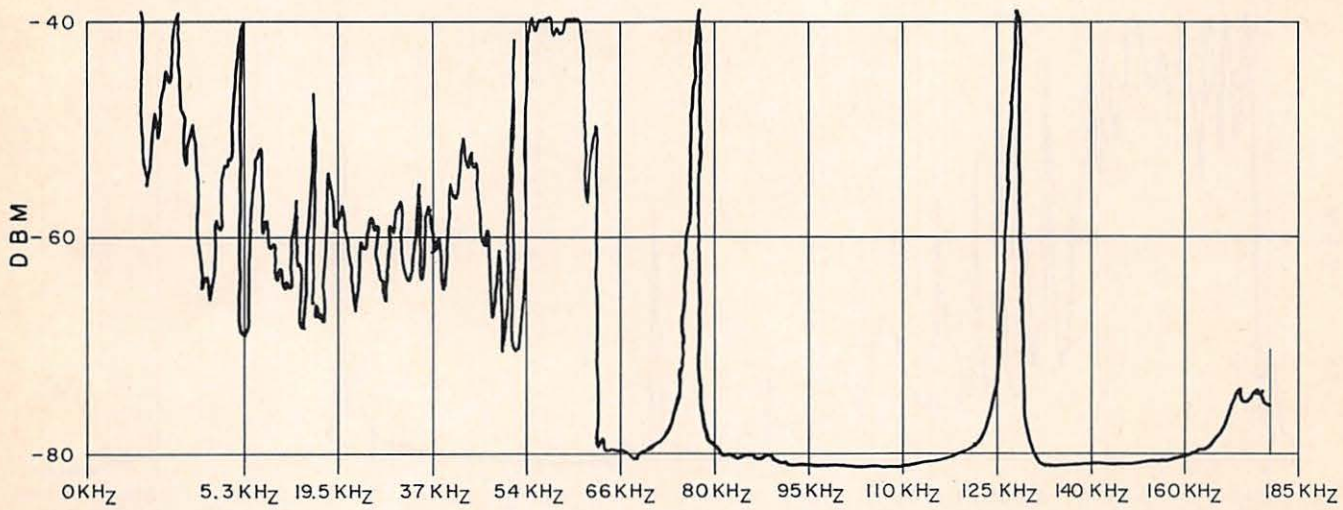


CHART C-3: Measured circuit No. OT-6 southward at The Dalles, Ore.; 150 miles No. 9 copper. Test was made 6/5/70 at 6:03 am. HVDC line transmitting 1440 megawatts south to north. Weather was clear.

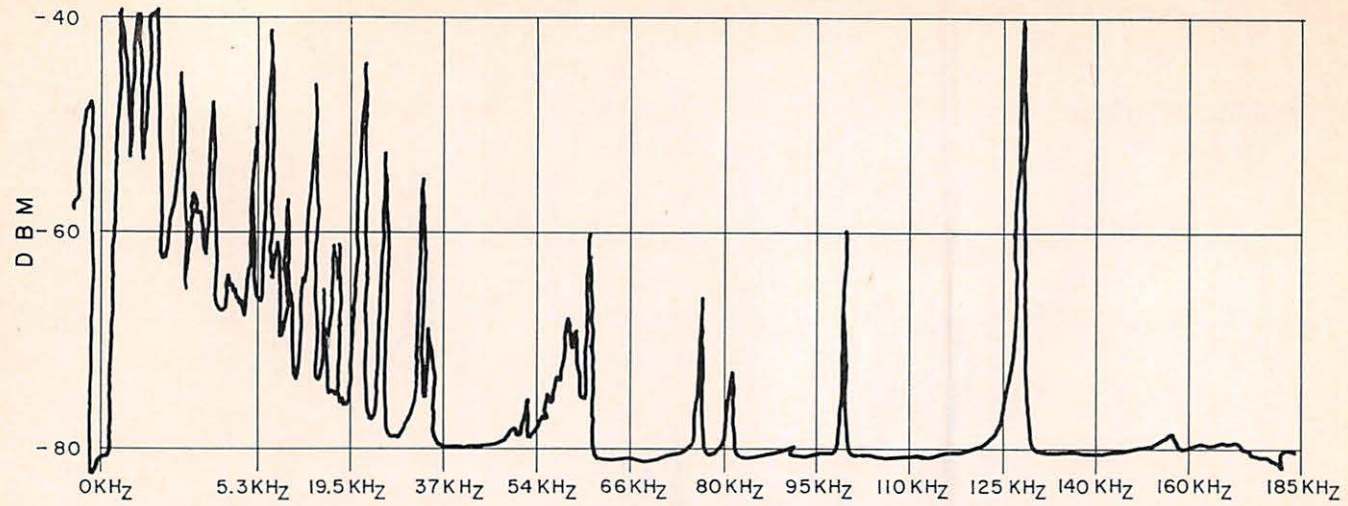


CHART C-4: Measured circuit No. OT-6 southward at The Dalles, Ore.; 150 miles No. 9 copper. Test was made 6/5/70 at 6:40 am. HVDC line was not transmitting any power. Weather was clear.

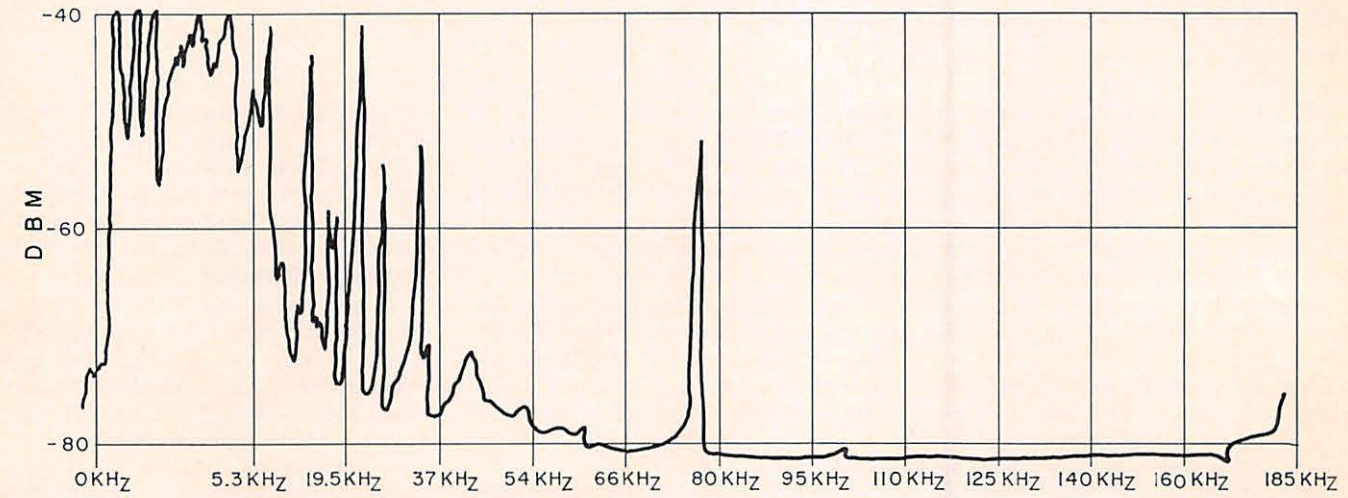


CHART C-5: Measured circuit No. OT-6 southward at The Dalles, Ore.; 150 miles No. 9 copper. Test was made 6/5/70 at 2:05 pm. HVDC line transmitting 900 megawatts north to south. Weather was clear.

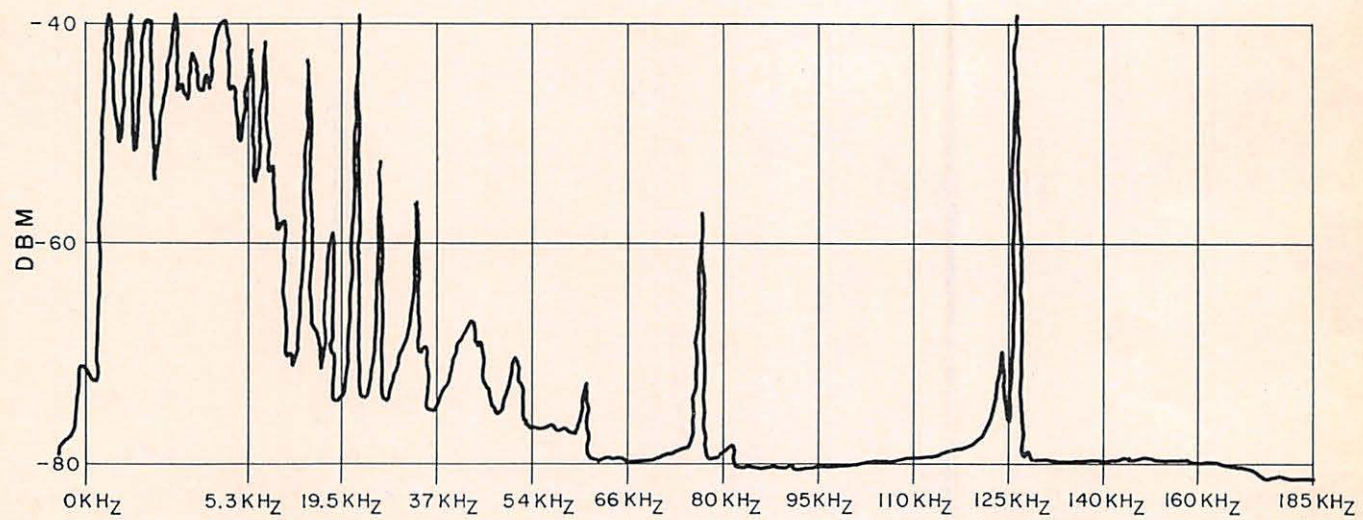


CHART C-6: Measured circuit No. OT-6 southward at The Dalles, Ore.; 150 miles No. 9 copper. Test was made 6/5/70 at 2:40 pm. HVDC transmitting 900 megawatts north to south (230 kv open). Weather clear.

HVDC lines may limit use of open-wire carrier

distance of 2100 ft with separation between the two lines varying from 250 ft to 600 ft.

These tests indicated almost exactly the same conditions which existed on the north end of the line with one exception. An increase in audio noise in the voice frequency range of considerable magnitude resulted when transmitting power south to north, as measured with a Western Electric 3A noise measuring test set, using "C" message weighting and 3 KHz flat measurements.

Open wire carrier systems are normally operated with a repeater spacing of 35 db to 40 db which results in a received signal of from a minus 17 dbm to minus 23 dbm, assuming a plus 18 dbm transmit level at the line for test tone. If this carrier system is being utilized for data transmission, such as Teletype, CTC codes or hotbox indications, it is normal to operate the aggregate of all channels at least 8 dbm below test tone level. Therefore, if a VF channel was equipped with 8 data channels, the individual data channels would be operating at a level 17 dbm below test tone. This means at the end of a carrier repeater section where the received carrier was normally a minus 23 dbm, the individual data channel would be operating at a level of a minus 40 dbm and a signal-to-noise margin of at least 20 dbm should exist for error free operation.

These figures are all based on normal operation under dry weather conditions, but during wet weather or during ice conditions, as line attenuation increases the received voice carrier level will decrease, resulting in a further decrease in signal-to-noise margin.

As the charts of the interference indicate, the noise in many cases approached and sometimes exceeded a minus 40 dbm which results in no signal-to-noise margin during these periods. Naturally, dependable operation of railroad carrier systems during these noise conditions is impossible.

It is impossible to increase the signal-to-noise ratio of the carrier signal by transmitting the signals at a higher level due to the design limitations of the carrier equipment itself. Transmit signals in excess of plus 18 dbm overload the amplifiers and intermodulation results, which creates a situation as detremental as the poor signal-to-noise ratio. The only other solution would be addition of repeaters which would result in a greater received signal level. Of course, this increases costs for the equipment requirements for housing, power etc., as well as increased maintenance expense.

It now appears that unless some action is taken, the use of open wire carrier systems will be seriously limited in the vicinity of these HVDC lines. The VF or audio portion of the band appears, at this time, to be sufficiently well filtered so that no serious interference will result under normal operating conditions. It must be remembered, however, that any condition on this line which results in a continuing arc will result in frequencies throughout the frequency spectrum being transmitted over the entire length of the line. Due to the low impedance of the line to ground, these tones could be radiated for a considerable distance from the line.

This brings you up to date on the status of the inductive subcommittee. I have not been so closely associated with the cathodic test program, but I will review the situation as far as I have information available.

In July 1969, LAWP and BPA installed a test rectifier at The Dalles having an output of 3000 volts and 300 amperes. Tests were conducted for several weeks at various current levels utilizing an earth return to permit all interested parties to make measurements and accumulate test data. This data was furnished to Ebasco Corp. who consolidated the information obtained and presented a preliminary report in San Francisco early in December to the cathodic subcommittee. They also furnished their recommendations for test locations where data should be obtained during the full scale earth current test period.

The report was quite thorough for the test rectifier period, and a very extensive test area was arranged for the cathodic test period.

Extensive tests were made during June 1970 by the railroad and pipeline companies in the period set aside for earth current testing and this information has been turned over to the Ebasco Corp for evaluation and inclusion of their report to the national task force.

This report will be forthcoming in the near future and copies will be available for interested parties. From the tests made on Union Pacific facilities, it appears the earth currents will not present a problem on DC track circuits, as in no case did voltage gradients in the track sections being measured exceed 40 microvolts per foot parallel to the track with 1800 amperes earth current.

I am sure you will agree there are some problem areas attendant with HVDC power transmission and much needs to be learned about this new form of electrical pollution. As with any other form of pollution, certain steps must be taken by the producers of that condition to protect the interests of society.

A meeting was held September 4 in Chicago by the AAR HVDC committee of the Research division, representing the railroads on the Inter-Utility committee, which reports their findings and recommendations to Ebasco.

The pipeline group of the Inter-Utility committee is making a recommendation to Ebasco that they include in their report a recommendation that any utility utilizing DC transmission limit earth current to one percent (1%) of full load system capacity, to a maximum of 25 amperes; and faults resulting in excess of these values shall be cleared within one second. A resolution was passed at the AAR meeting to support the pipeline group in this recommendation.

As no recommendations have been forthcoming from the inductive coordination sub-committee of the Inter-Utility committee due to the preponderance of electric power company representatives on this committee, it is doubtful if one will be forthcoming.

A resolution was passed at this meeting that Ebasco include in their report a recommendation that any utility utilizing DC transmission provide adequate filtering in the HVDC system to limit interference to railroad signaling and communications facilities so as not to exceed a level of 60 db below one milliwatt for any frequencies between DC and 270 KHz.

R. J. Berti, electrical engineer, UP, who is chairman of this AAR committee, was instructed to request the pipeline group to support this resolution and make every effort to have it included in their report to Ebasco.

Your assistance is solicited to support these resolutions insofar as possible with the government regulatory bodies, as the use of HVDC lines will almost certainly extend throughout the country in a few years. Then what now is our problem will become your problem.

We have considerable support from other groups, particularly the IEEE wire communications inductive coordination group who have formed an HVDC subcommittee to study the effects of HVDC and ultimately hope to establish standards which will be acceptable to the various power company regulatory bodies of what limits of power interference will be permissible for a power company to generate.

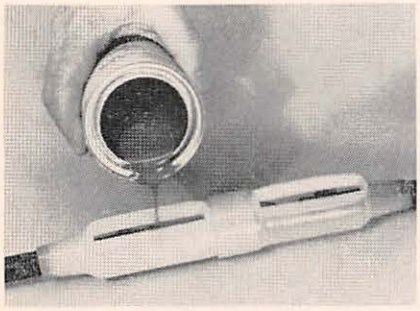
Product News

Data system operates up to 600 bits/sec (101)

The 25B, a data, telegraph and telemetry transmission system, is designed for universal application at transmission speeds of 75, 110, 150, 200 and 600 bits per second.

By making more economical use of voice circuit bandwidth, the system offers reduced costs and therefore greater profits over similar data communications equipment. For example, up to twenty-five 75 bps channels, eighteen 110 bps channels, twelve 150 bps channels, eight 200 bps channels, or a single 600 bps channel and a number of lower speed channels can be processed by the 25B for transmission over a single ordinary voice-frequency circuit.

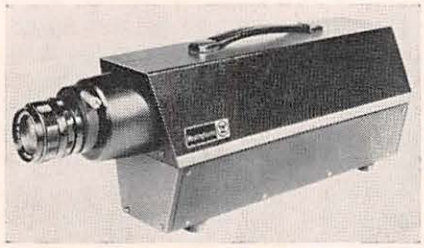
Featured by the 25B system is a basic commonality of equipment: a shelf assembly for multichannel installations, and a choice of three single-channel terminal subsets depending on application. Each system adheres to the accepted telecommunications standards of the EIA, Bell System and CCITT. *Lenkurt Electric Co., Inc.*



Splice kits feature urethane material (102)

Hyseal urethane splice encapsulating kits can be used for splice encapsulations on cable as cold as 0 deg F, merely by warming the compound to 50 deg F. Body heat, or heat from a vehicle engine block can be used. Penetration of the splice bundle is excellent, due to the low viscosity of the compound, and gel time is rapid even at low temperatures.

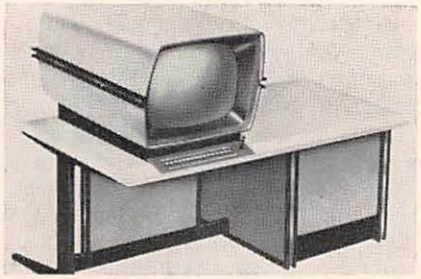
The cured material has a dielectric strength greater than 500 volts per mil. The kit is specifically recommended for communication splices on PIC cable. *Hysol Division, The Dexter Corp.*



Television camera works on low-light level (103)

Two new SEC (Secondary Electron Conduction) television camera models, STV-706 and STV-713, are highly sensitive for viewing in low-light-level conditions. The STV-706 camera is the standard model for general-purpose low-light-level use; the STV-713 camera is equipped with an image intensifier for viewing in darker areas with extremely low light level. These one-piece cameras are easily portable for surveillance of events in different areas, or they can be mounted in a weatherproof enclosure for day/night surveillance of a specific location. The cameras are compatible with any standard 525 line/frame video monitor or video tape recorder.

These cameras also feature automatic gain control, low lag, broad spectral sensitivity, low power consumption, and basically a "hands-off" operation once the camera is set up properly. *Westinghouse Electric Corp.*



Graphics terminal is computer I/O unit (104)

A new model 8190 graphics terminal generates and displays graphics, alpha-numeric characters and symbols from digital input data. It contains a digital to analog interface as well as the analog circuits and function generators necessary to display data generated by a general purpose computer. The basic terminal contains a CRT graphic monitor and position, vector, and character generators, packaged in a desk type console. Options such as display processor, memory, general purpose computer, light pen, etc. are available.

Position, vector, and optional circle /arc generators are incorporated in the function generator, which supplies deflection and intensity signals to the CRT. The character generator features a repertoire of 64 alphanumeric character and symbols. Characters are programmable in four sizes (⅛H x 3/32W to ⅜H x 9/32W) and in vertical or horizontal orientations. The CRT is 21", rectangular, with 12" x 12" display area. Maximum writing time per character is 10 microseconds with faster speeds available. Graphics writing speed is 200,000 inches per second. Random positioning time is 14 microseconds for full scale deflection. Character-to-character positioning time is 3 microseconds. *Monitor Displays*

Data set can transmit at 3600 bits/sec (105)

A data set capable of transmitting at 3600 bits-per-second over dial-up telephone lines is the modem 3300/36. It offers a 150 bps reverse channel. This allows maximum throughput by eliminating the line turnaround time normally encountered with high speed dial-up operation. The model also operates over unconditioned leased lines. *International Communications Corp.*

Telephone can be I/O device to CPU (106)

The Datatone RTCT (Receiver Tone Calling Terminal), allows any tone-button telephone location to be

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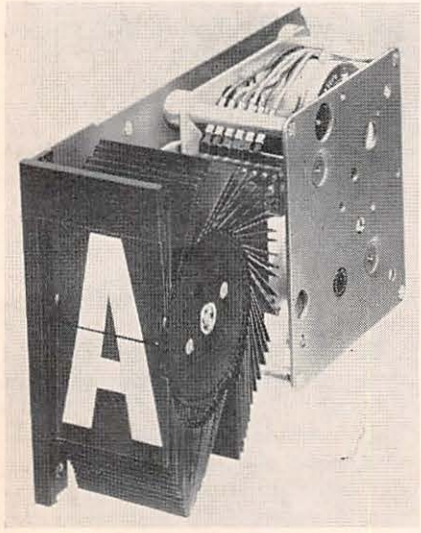
used for control or computer input functions over any commercial or private communications link. The terminal is fully compatible with Touch-Tone calling and all other telephone systems and operating practices making use of presently available tone-button telephones. No special line matching equipment is required. Non-loading and designed to bridge a 600 ohm line, RTCT consists of miniaturized, transistorized modules employing neither tuned reeds nor tuning forks. Datatone modular systems (RTCT and KTCT) permit tailoring to each user's specific minimum needs and systems may be expanded easily at any time by simply plugging-in additional modules. *Datatone Division, Trepac Corp.*



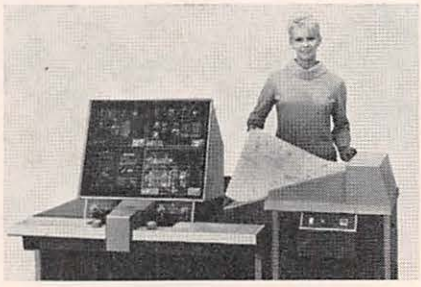
Alphanumeric modules are for display (107)

A new line of alphanumeric split flap modules are for information display systems. A display board can utilize an unlimited number of these modules, positioned in relationship to the information display needs. Input for these systems can be taken from teletypewriter, tape recorder, computer TX/RX or simply keyboard. *Conrac Corp.*

Computer series has 24-bit word length (108)

The advance 6000 series computers have a word length of 24 bits plus a parity bit. Automatic parity checking performed on all memory references between memory and central processor and/or input/output channel. Magnetic core memory has completely parallel operation (all bits of each word are transferred in parallel). Memory size is 8192 words expandable to 32,768 words—all directly addressable. Cycle time is 1.9 microseconds.

Memory expansion is up to a directly addressable 32,768 24-bit words. A choice of several types of buffered channels including character, word, variable format, cyclic, multiplex, direct access, and high speed are available. Up to 8 fully buffered input/output channels, most having the capability of serving 16 external devices are available. Up to 4,096 external sense and control lines are available. Internal timers have fixed time frequency interrupt or programmable interval interrupt. Special options include analog-to-digital and digital-to-analog control units. *EMR div. Weston Instruments Inc.*

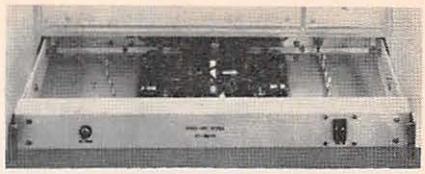


Computer-originated microfilm handled (109)

The 335 Transflo processor can process and reproduce computer originated microfilm. A view mounter (model 35VM), RS and SS 18.24 reader-printers, OP-60 card duplicator and OP-61 add-on module, and automatic platemaking machines—are compatible with other microfilm systems.

Primary use of the Itek 3536 microfilm camera is to simplify the microfilming of large and small engineering documents. The detachable take-up magazine, containing exposed film up to 100 ft, can be removed from the camera and placed directly on the 335 Transflo processor for daylight loading. Maximum size of originals is 45" x 63". Any film size from 16mm to 105mm can be processed without scratching and to provide archival quality. Four rolls of 16mm or three of 35mm may be processed simultaneously.

The RS 18.24 reader-printer accepts 16mm and 35mm film. Images are magnified 14.5x and displayed on the 18 x 24 inch screen. This unit provides sharp, high-contrast prints in less than 30 seconds. As many as 21 copies can be operator-selected and printed automatically at the rate of four prints per minute for handling. Maintenance is kept to a minimum by using pre-mixed chemistry and 440 ft rolls of paper. *Itek Business Products.*



Four-wire bridge has flat response (110)

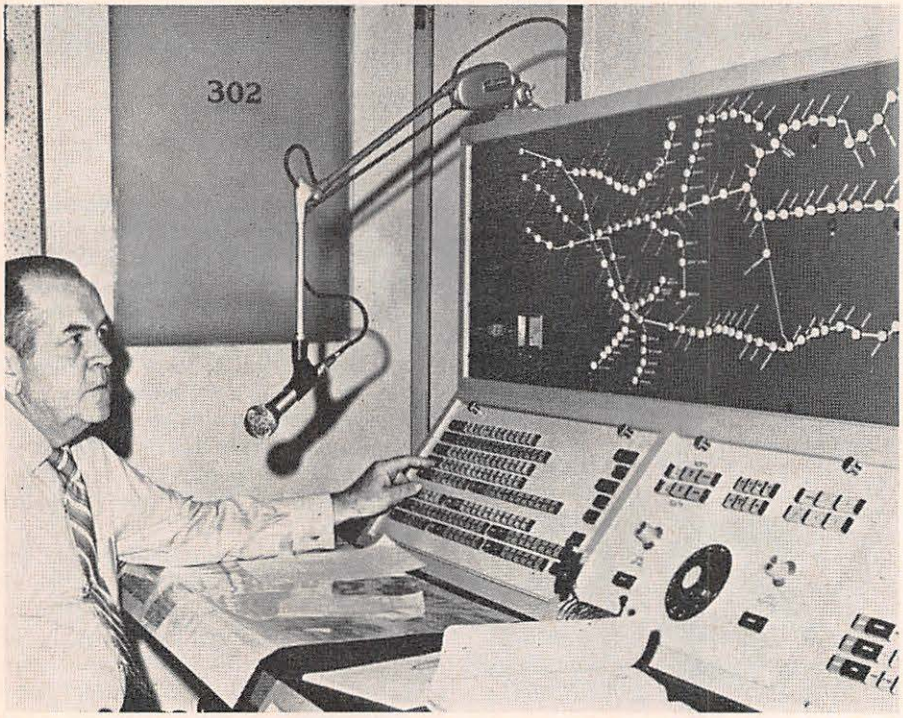
A new three-way, four-wire active bridge provides essentially flat response from 300 Hz to 3 MHz so that the total baseband of a 600-channel microwave system, including the service channel is available at repeater points. Neither transformers nor filters are required for baseband access. Isolation between associated input and output legs is in excess of 75 db at all frequencies, and is independent of source and load impedance.

Input and output impedances are 75 ohms, input level to each leg of the bridge is −15 dBm maximum, there is a medium loss through the bridge of 12 db, and internal pads provide an additional internal level adjustment of about 16 db. The bridge operates from −24 volts DC or −48 volts DC and can be used with any radio or multiplex equipment which provides appropriate levels and impedances. *Farinon Electric.*

OCR system reads typed or printed items (111)

A new optical page-reading or journal tape-reading system, the Farrington OCR (Optical Character Reader), reads information either typed or printed, edits and formats it, and then produces a magnetic tape output of digital data. This output can then be fed to a computer. The system takes the place of keypunching, keytape, keydisc, etc., and with proper forms design, can eliminate any rekeying of the data. The Farrington 3030 page reader has a reading speed of 400 characters per second. The 3030 system is actually a general purpose digital mini-computer (Varian 620/i) that has a memory storage of 4,096 words of 16-bit length, expandable to 32,768. The 3030 OCR system has a demand sweep mode, under program control, which determines the length of the reader's line sweep. It also has skip-to-mark, underscoring, matrix mark reading and character-, word- and line-delete functions. All of these are facilitated with the minicomputer's ability to store a comprehensive program for them. *Varian Data Machines.*

News Briefs



PA system covers 83 stations on LI

A public address system covering 83 passenger stations on the Long Island has been placed in service. All PA speakers on the station platforms are connected into the Jamaica terminal headquarters via existing railroad telephone cables. A master console, including a map of the railroad showing stations is located in the Movement Bureau at Jamaica station. By next spring, 33 more stations will be added to the PA system, bringing a total of 116 stations, out of 157, into the general public address system. The console which is approximately seven feet long and five feet high contains color-coded pushbuttons so that the announcer may cut in any one station, several stations simultaneously or any portion of a branch line or the entire railroad. When the announcer is making the broadcast, station points are lighted up on a map to indicate to him the station to which he is making the announcement.

Equipment and design of the PA console was a joint effort of Cardion Communications and the Long Island.

B&O installs electronic telephone switchboard

An electronic telephone switchboard to be interconnected with the Bell System is being installed by the Baltimore & Ohio at Cumberland, Md

B&O will lease the telephone system from Stromberg-Carlson Corp. for interconnection with the Chesapeake & Potomac Telephone Co. The new system will provide Tone-Dial telephone service for division headquarters personnel over the railroad's private communication system and message circuit lines and access to the nationwide telephone network.

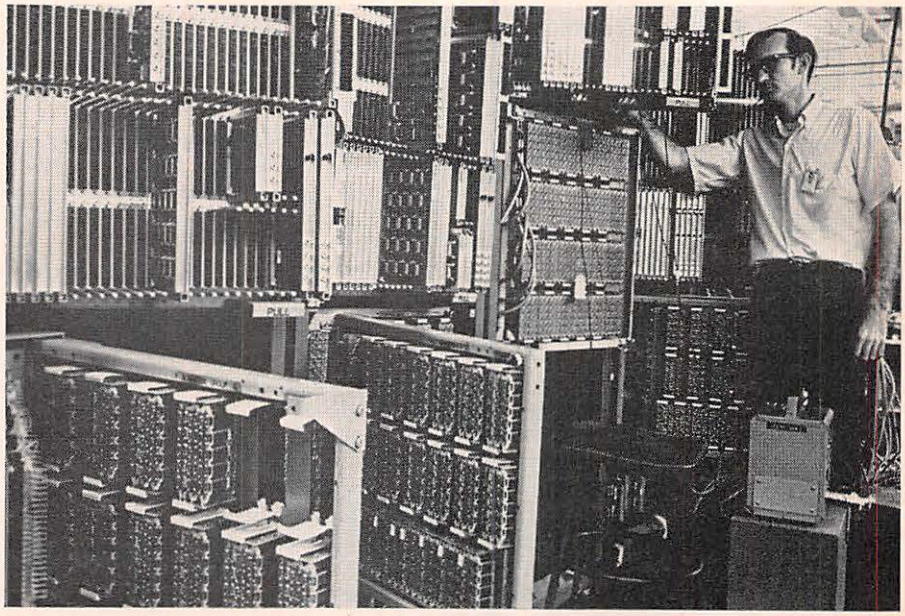
The Crossreed switchboard will provide 300 telephone lines for the B&O. It will also have the capability of handling future data transmission, an advantage of electronic switching over electromechanical switchboards.

Besides tone dialing to any point on both private and public networks, the system's special features will include two types of conference calls. Users will be able to call a special "meet-me" number for a large telephone conference, or, on equipped telephones, add a distant party to an existing call by dialing that party. Paging throughout the headquarters building will be possible from any telephone on the new system.

The Crossreed switchboard, housed in cabinets, is self-testing. Its modular construction facilitates maintenance and the B&O will provide its own service and maintenance.

CN orders CTC for mainline

Canadian National will install centralized traffic control on 96 miles of double track between Kingston, Ont. and Dorval, Que. Control will be from a traffic control center at Belleville, Ont. Equipment has been ordered from General Railway Signal Co. and includes model 55F dual-control switch machines and type SA-1 searchlight signals. Block indications will be transmitted via type F2 carrier. A system 4000 high-speed electronic coding will be used to bring controls and indications to the Belleville CTC center. Eighteen controlled locations will be included in the Kingston-Dorval section. Also to be included in control at Belleville, will be switches and signals at Caron,



Ont., approximately 200 miles distant.

Long Island extends electrification

October 19 marked the opening of the Long Island's electrification extension, some 16 miles from Mineola to Hicksville and Huntington, N.Y. The $69-million extension of electrification from Mineola is the first major extension of third rails since the Montauk branch was electrified to Babylon in 1925 and brings the total route mileage of electric territory to 119. Eleven new substations were constructed between Mineola and Huntington to provide power for the third rail.

Servo hotbox detectors installed in Europe

German Federal Railroad is presently in the process of installing 50 hotbox detectors manufactured by Servo Corp. of America. Also, British Railways are installing 26 Servo hotbox detectors.

North of the border, Canadian National now has 30 Servo hotbox detectors, either being installed or in service.

LI extends crossing protection program

Long Island is now in the process of installing flashing light signals and automatic half gates at 176 crossings. The $3.5 million project, estimated to take five years, is going at the rate of 36 installations during this current year, 17 during the second year and 41 each for the final three years. These are concurrent with New York State's fiscal years, as the funds are being supplied by the State Department of Transportation. At least 200 crossings are already protected by gates on the Long Island. At five crossings in Suffolk County, Railroad Accessories Corp., model GS Type III, automatic hydraulic gate mechanisms are being installed.

Signalmen vote to strike in case mediation fails

Brotherhood of Railroad Signalmen's Grand Executive Council has been authorized to call a strike should it become necessary if their present mediation efforts do not succeed. Result of the strike ballot showed 98.55% of the members voted for a strike. Meetings with the Mediation Board were resumed September 9. Present mediation is on increase in wages and improvements in other working conditions.

Left hand signal rule under fire by BRS, BLE

Protest by the Brotherhood of Railroad Signalmen and the Brotherhood of Locomotive Engineers prompted the Federal Railroad Administration Safety Board to stay the FRA examiner's report and order that would allow roadway signals to be positioned and aligned so that they can be readily associated with the track on which they govern movements. The Safety Board amended Section 236.21 to read as follows:

"Each roadway signal must be (a) positioned and aligned so that the indication it displays can be clearly associated with the track it governs and (b) located over or to the right of the track it governs in other than single-track territory."

Association of American Railroads has filed a motion to set the rule aside and permit signal installation on either side of the tracks they govern. BRS and BLE have indicated they will oppose the AAR's action.

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- Interlocking circuit design
- Cab signal system design
- AF track circuit design
- Automatic speed control design
- Automatic train operation systems design
- Code systems design

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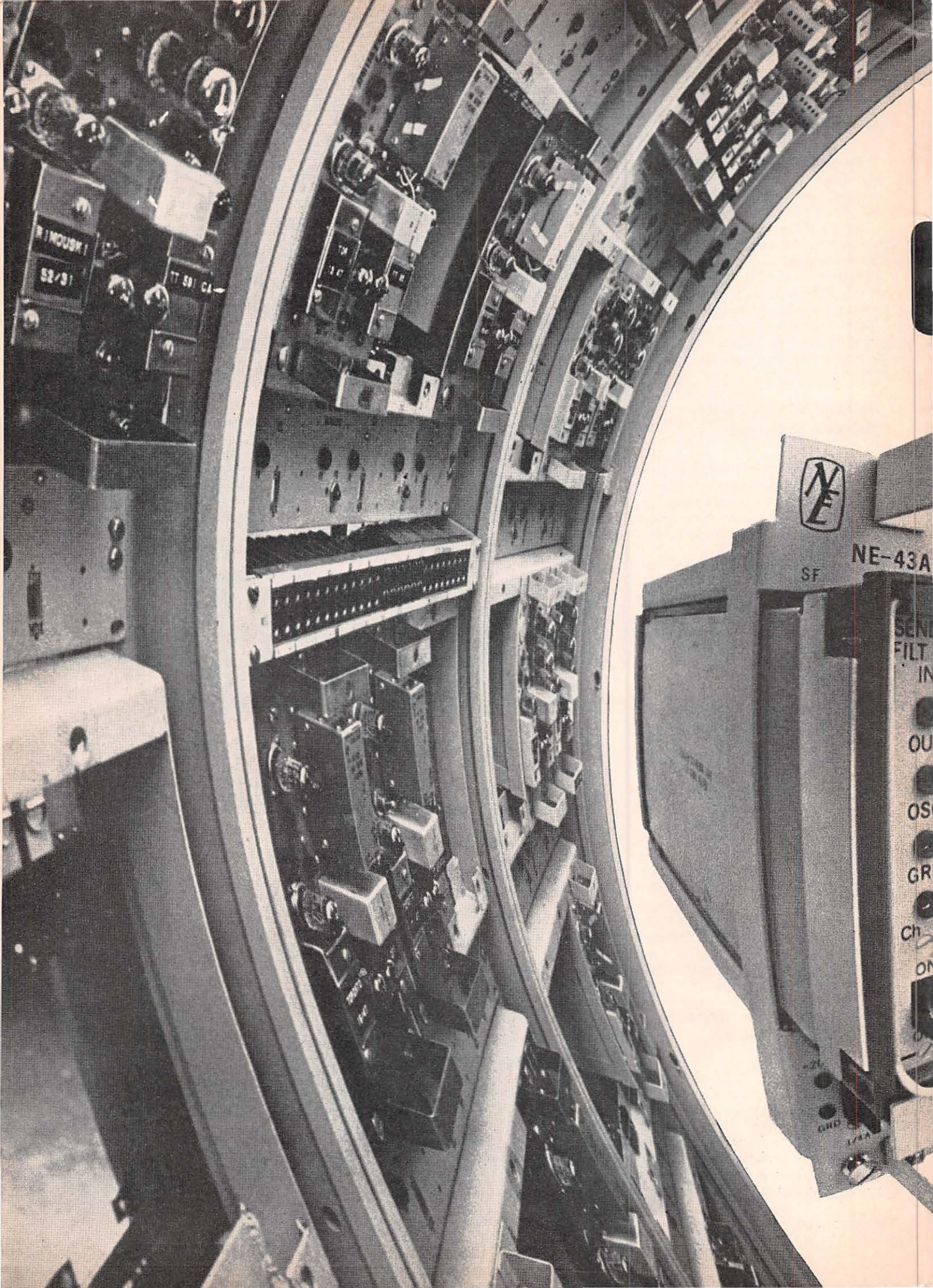
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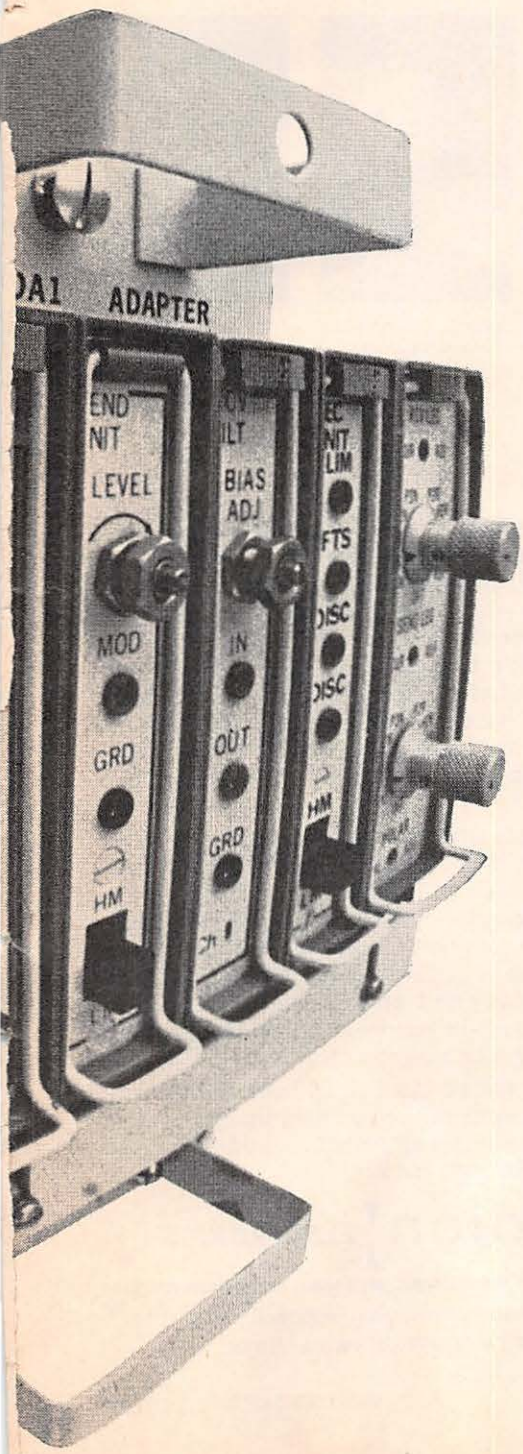

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Whichever way you use the DA-1, end-to-end, back-to-back, or to adapt 43A1 . . . it provides an economical way to expand existing VFCT networks.

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Find out how compatible and competitive our systems really are. For the full story write: Jack Percival, Transmission Division, Northern Electric Company Limited, Montreal, Quebec, Canada. Or phone (514) 931-5711.

Northern Electric
Company Limited

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People

ANSONIA WIRE & CABLE CO.: Elvin R. Beck appointed manager railroad sales with offices at 346 Suburban Station, Philadelphia, Pa.

BAYLY ENGINEERING LTD.: T. H. Walther appointed vice president and general manager.

COPPERWELD STEEL CO.: Roy Cook appointed sales representative at Columbus, Ohio, to cover the states of Indiana, Michigan and Ohio.

GENERAL AUTOMATION INC.: Paul D. Malick appointed midwest district manager in charge of sales and technical operations center at 2590 East Devon Avenue, Des Plaines, Ill. Raymond J. Noorda appointed vice president and director of planning with headquarters at Santa Ana, Calif.

GENERAL CABLE CORP.: Clifton P. Grant appointed vice president—technology.

GT&E INFORMATION SYSTEMS INC.: Leonard A. Muller, senior vice president Sylvania Electric Products Inc., elected president.

GRAPHIC SCIENCES INC.: Hiro R. Hiranandani appointed group vice president. G. Scott Brodey appointed vice president sales.

HY-GAIN ELECTRONICS CORP.: Harold J. Curry and Guenther P. Bethscheider appointed sales representatives at Kansas City, Mo. to cover the states of Kansas, Missouri and Southern Illinois.

LYNCH COMMUNICATION SYSTEMS: Alan Urschel, formerly with Collins Radio Co., appointed vice-president of marketing. John G. Clay-

Elvin R. Beck
Ansonia Wire & Cable

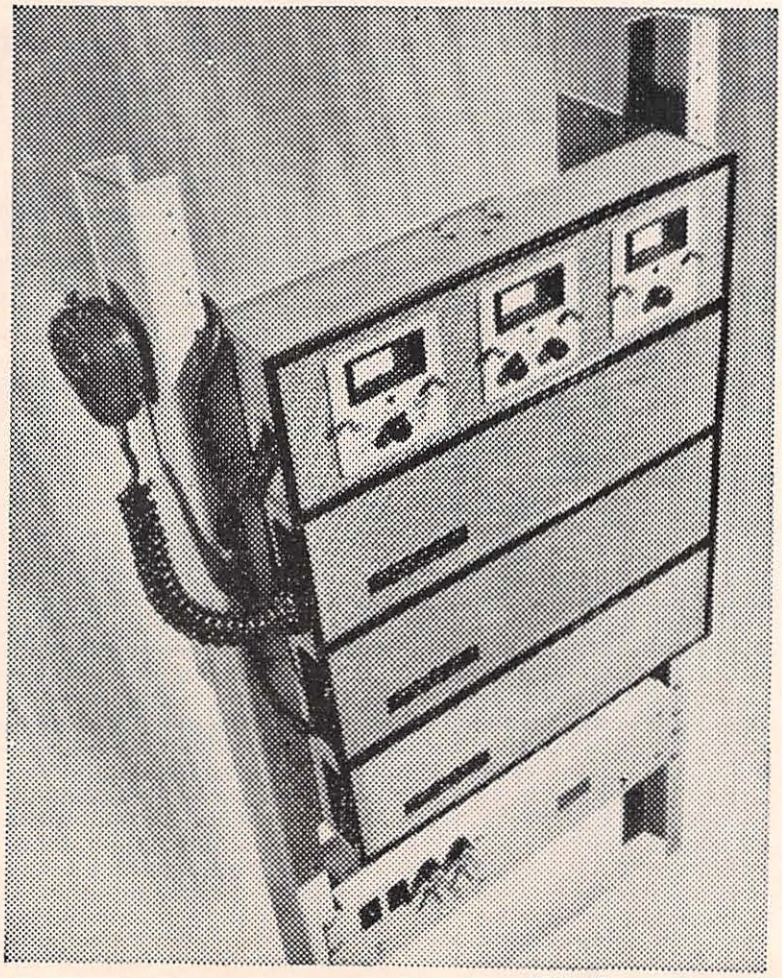
John W. Porter
General Ry Signal

Leonard A. Muller
GT&E Information

Robert Buran
Lynch Comm.

John G. Claypool, Jr.
Lynch Comm.

Julius C. Tervay
Nife Inc.



The new FCC rules drastically limit the areas where the 450-470 MHz band can be used for point-to-point communications — and give you a couple of years to make the changeover if you come under the new rules. But doesn't it make sense to change to 960 MHz now, before the rush is on? Particularly when you have available to you, from Cardion, the first solid-state, FCC type-accepted 952-960 MHz radio relay equipment in the industry.

Cardion's new equipment extends the state-of-the-art. You can get up to 5 separate voice channels, each with its own control circuit uplink and carrier-operated relay circuit downlink. You can get duplex operation over a single pair of radio frequencies with just one antenna and one transmission line. And you do get a built-in service channel, independent from multiplex equipment.

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Wanted—Old books on signaling, also old signal apparatus. Must be pre-1930. Write, giving all details to **P. M. Brannen, 609 Lacey Drive, Endwell, N.Y. 13760.**

pool, Jr., appointed communication engineer at Kansas City and will cover the states of Nebraska, Eastern Colorado, Kansas and Missouri. **Robert Buran** appointed communication engineer at New Rochelle, N.Y. and will cover the states of Pennsylvania, New Jersey, Delaware, Washington, D.C. and West Virginia.

NIFE INC.: **Julius C. Tervay,** western district manager, appointed sales manager at Copiague, N.Y.

OKONITE CO.: **Richard A. Guba** appointed manager-industrial marketing.

PULSE COMMUNICATIONS INC.: **Francis R. Cosh** appointed assistant vice president and will be responsible for marketing.

RAILWAY SIGNAL & COMMUNICATIONS SUPPLIERS ASSN.: **John W. Porter,** executive vice president General Railway Signal Company, elected chairman and president succeeding **William A. Edwards,** vice president and general sales manager Kerite Co.

SANDS MEASUREMENT CORP.: **Donald W. Wessels,** formerly sales manager for KarTrak ACI Systems of Sylvania Electric Products Company Inc., appointed vice president for marketing of a new computerized coupled-in-motion railroad weighing scale.

SANGAMO ELECTRIC CO.; **Anthony J. Paoni** appointed manager market development, Transitel Computer Support Systems.

WARREN COMMUNICATIONS: **Melvin Niziolek** appointed regional sales engineer, LaGrange, Illinois, to cover the states of Michigan, Indiana, Illinois, Wisconsin, Minnesota and Iowa. **J. Fred Elmen** appointed regional sales engineer, Atlanta, Ga., to cover the states of Georgia, Tennessee, Mississippi, Alabama, Florida and South Carolina.

WESCOM INC.: **Gordon Hayes, Jr.,** appointed product manager transmission equipment.

Obituaries

RAYMOND B. GRANTHAM, microwave engineer, Santa Fe, died August 17.

JOHN HENSEL, retired signal sales engineer, Western Cullen Division, Federal Sign & Signal Corp., died October 11.

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Derails or signals? Each has its place: signals are obeyed by men; Hayes Derails are obeyed by equipment.

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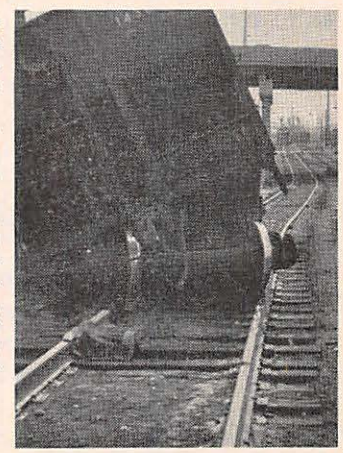

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Editor's Corner

Know your regulators

Consider the following: On *September 23, 1970,* the Illinois Commerce Commission issued an order concerning the inspection of trains moving over 30 mph hauling liquified petroleum gases in tank cars. On *October 14, 1970,* the Hazardous Materials Regulations Board, Federal Railroad Administration, issued a request for public advice on speed restrictions on tank cars, also carrying liquified flammable gases.

Railroads are to submit plans to the Illinois commission within 180 days, and comments are to be received by FRA's HMR board by Dec. 16, 1970.

The Illinois order concerns "enroute inspection of trains to detect overheated bearings and dragging equipment either through the use of appropriate electronic and mechanical devices or by visual observation, the inspections to be made on all lines in Illinois where train speeds in excess of 30 mph are permitted. . . . No train the consist of which includes a car or cars containing flammable compressed gases which has moved for a distance of more than 35 miles from any classification yard, terminal or major interchange point without being inspected visually or electronically [see above] hereinbefore shall pass through any incorporated village, town or city at a speed in excess of 25 mph . . . this order shall in no way be construed so as to relieve members of engine crews from the responsibility of making frequent inspections of their trains." Also, rear trainmen, or any railroad employee must inspect moving trains, note and report on conditions.

TANK CARS INTEREST FRA

The Hazardous Materials Regulations Board, FRA, is "considering proposing, among other things, that the speed of trains carrying liquified flammable gas in . . . tank cars having a capacity of 25,000 gallons or more, be limited to a maximum of 25 mph when moving through incorporated communities, unless one of the following provides qualified mechanical or visual surveillance of the train within 35 miles of the limits of such communities:

"(a) Hotbox detector; (b) Initial terminal, interchange or 500-mile inspection point; (c) Roll-by inspection at crew change point; or (d) Qualified railroad personnel adjacent to the track.

"A positive indication of satisfactory surveillance or inspection of the train would have to be received by the train crew in the caboose, and that information would then have to be transmitted to the engineman."

The HMR board is interested because of derailments at Laurel, Miss., and Crescent City, Ill., in which tank cars carrying liquified flammable gases exploded and burned causing considerable property damage. The recently enacted Federal Railroad Safety Act of 1970 includes a section on hazardous material control under the jurisdiction of the Secretary of Transportation.

One thing is clear, state and federal agencies concerned with safety are communicating. It would be in the best interests of railroads if they would communicate with these agencies, possibly on a regular basis. It might be worthwhile for railroads to maintain constant liaison with state regulatory agencies, if such is not now being done.

MORE WORK FOR S&C

It seems apparent that there will be more work for signaling and communications departments. Hopefully, railroad managements will see the wisdom of granting these departments the necessary funds to obtain hotbox and dragging equipment detectors. Also, funds should be made available for the manpower to install and maintain these safety devices.

The Federal Railroad Safety Act of 1970 states that the Secretary . . . "shall conduct as necessary . . . evaluation and training for all areas of railroad safety. However, nothing in this title shall prohibit the bargaining representatives of common carriers and their employees from entering into collective bargaining agreements under the Railway Labor Act, including agreements relating to qualifications of employees which are not inconsistent with rules, regulations, orders or standards prescribed by the Secretary."

The 1970 Safety Act also declares that state and federal rules shall be "nationally uniform to the extent practicable." States may have more stringent rules and regulations pertaining to safety when not incompatible with federal rules and "when not creating an undue burden on interstate commerce."

While present FRA signal rules go far towards improving safety, it would appear that qualifications and standards for maintenance personnel may be required by FRA rules yet to be written.

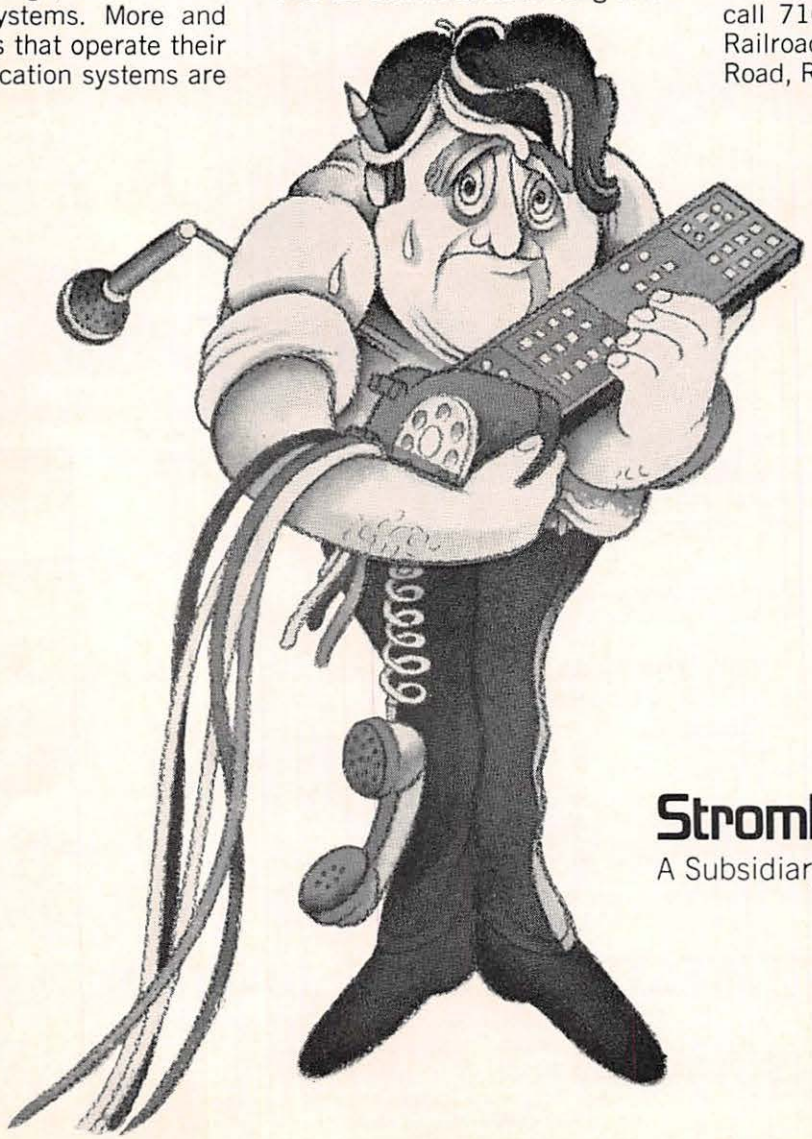
Bits and pieces, odds and ends: Who wants a piecemeal communication system when freight revenue is at stake?

A system of diverse bits and pieces of communications gear from scattered sources can't be the best way to serve the telephone and data needs of your railroad. An objectively designed, completely integrated system is required to do the total communications job—the Systematics approach, from Stromberg-Carlson, the source of complete end-to-end systems.

We plan, design, service communication systems. More and more railroads that operate their own communication systems are buying them from Stromberg-Carlson. Our systems in actual operation include 252 PABX's (serving over 18,000 telephones); forty 4-wire network switching systems (handling over 2500 circuits).

The Systematics approach to problems keeps on delivering reliable communications for control and for administration long after installation. Because every system and every piece of equipment is fully backed by our total support services. The result of this objective and analytical approach to your communications needs by experts in this field is a unified system designed to your present and future service and that really delivers when you need it.

For the story on Stromberg-Carlson communication systems, call 716-482-2200. Or write to: Railroad Division, 100 Carlson Road, Rochester, N. Y. 14603.



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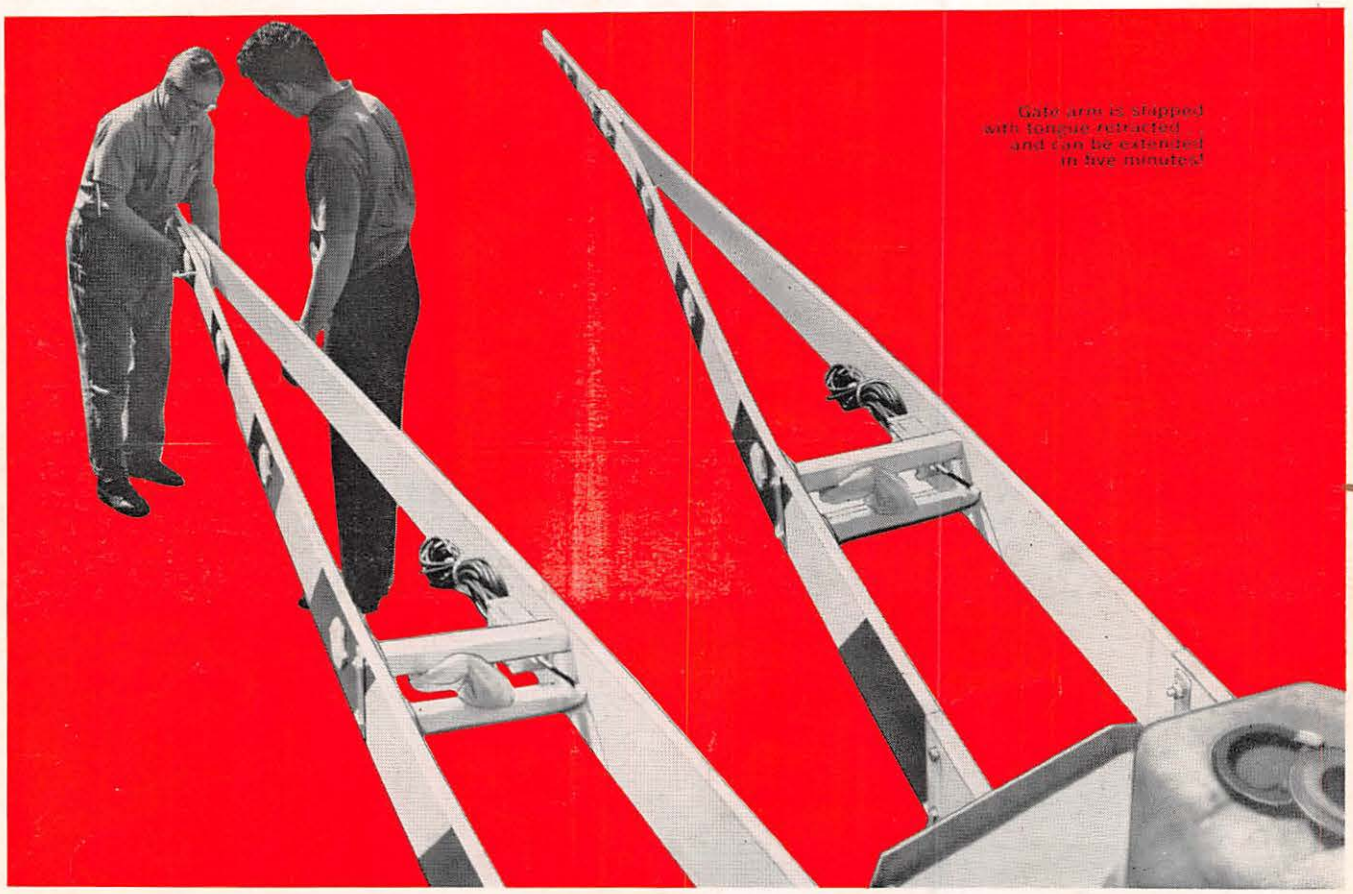

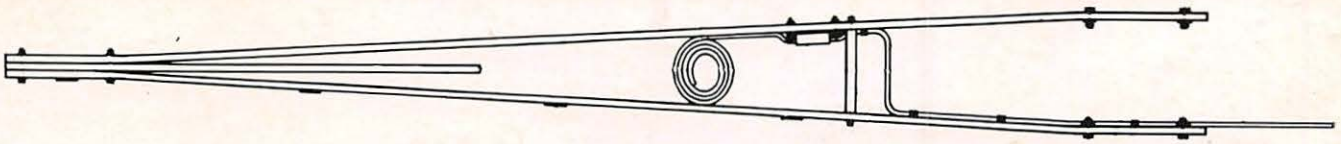

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